Routt National Forest

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Roads Analysis Report

Routt National Forest

May 2003

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Executive Summary

Introduction

On January 12, 2001, the Forest Service issued the final National Forest System Road Management Rule. This rule revises regulations concerning the management, use, and maintenance of the National Forest Transportation System. The final rule is intended to help ensure that additions to the National Forest System road network are essential for resource management and use; that construction, reconstruction, and maintenance of roads minimize adverse environmental impacts; and that unneeded roads are decommissioned and restoration of ecological processes are initiated.

This report documents the information and analysis procedure used for the Routt National Forest roads analysis. This analysis is designed to provide decision-makers with critical information to develop road systems that are safe and responsive to public needs and desires, are affordable and efficiently managed, have minimal negative ecological effects on the land, are in balance with available funding for needed management actions, and meet the objectives of the 1997 Routt Forest Plan.

Roads analysis is a six-step process. The steps are designed to be sequential, with an understanding that the process may require feedback and iteration among steps over time.

1. Setting up the analysis
2. Describing the situation
3. Identifying the issues
4. Assessing benefits, problems and risks
5. Describing opportunities and setting priorities
6. Reporting—Chapters 1-5 of this report

The amount of time and effort spent on each step differs by project based on specific situations and available information. The process provides a set of possible issues and analysis questions; the answers can help managers make choices about road system management.

Forest Supervisor Guidelines Response

In the October 2002 charge letter to the Interdisciplinary Team (IDT), the Forest Supervisor wanted four items included in the roads analysis report. They are listed below in bold with a discussion following.

An inventory and map of all classified (3, 4, and 5 level) roads and a description of how those roads are to be managed.

This report includes the following maps:

- A map displaying the existing inventoried level 3, 4, and 5 road system, with the road numbers. It also includes the inventoried level 1 and 2 roads without their respective road numbers.
- A map displaying the minimum road system by matrix categories. This map shows both the high and low value maintenance level 3-5 roads from the matrix in Appendix C. In subforest scale analysis, specific road management decisions will be made using this information.
- A map displaying the 6th-level watershed risk assessment on the entire Routt National Forest. The map should be used with the Watershed Assessment Table (Appendix A) and information about riparian dependent species in the terrestrial wildlife (TW) questions for subforest scale analysis.

- A map set displaying wildlife security areas, riparian areas where snow compaction is a concern, and critical wildlife habitat.
- A map displaying the Recreation Opportunity Spectrum (ROS) classes from the 1997 Routt Forest Plan.

Guidelines for addressing road management issues and priorities related to construction, reconstruction, maintenance, and decommissioning.

- Chapter 5 of this report contains guidelines and opportunities for addressing road management issues and priorities related to construction, reconstruction, and decommissioning.

Significant social and environmental issues, concerns, and opportunities to be addressed in project level decisions.

- The environmental issues that surfaced were concerns about the health and condition of some watersheds as a result of road impacts, effects of roads on wildlife, silvicultural concerns about the current and future health of the forest, and road access for fuel reduction projects and fire suppression, especially in the urban interface areas.
- There is an increasing demand for year-round access to private inholdings which can have environmental and social effects.
- Social issues include unclassified road use and development, trespass from private property, safety, and wilderness encroachment.

Documentation of the coordination efforts with other governmental agencies and jurisdictions.

- Appendix J and the Administrative Record for this roads analysis contains notes from meetings with the counties most affected by the Routt National Forest road system.
- Some counties and members of the public have expressed a concern about road-related decisions being made without public involvement. All road-related decisions must go through the NEPA process which includes public involvement.
- Contacts with the other counties resulted in a mix of potential opportunities. There are varying opportunities for the counties to work with the Forest in developing Road Maintenance Agreements for shared road maintenance and eligibility of county roads for federally funded road improvements.

Roads Analysis Report

The product of this analysis is a report for line officers that documents the information and analyses used to identify opportunities and set priorities for future national forest road systems. The key products of this roads analysis for subforest scale analyses include:

- A watershed risk assessment for all of the 6th-level watersheds on the forest.
- A wildlife risk assessment.
- A map of all of the 6th-level watersheds on the forest that displays the results of the watershed risk assessment.
- A map that displays the existing level 3, 4, and 5 road system on the forest.
- A road risk versus value matrix that identifies four categories of roads evaluated on a road-by road basis.
- A road risk versus value graph based on the road matrix.
- A map of the management categories for the level 3, 4, and 5 road system.
- A narrative response to the standard questions in Chapter 4 of FS-643, as well as a supplemental scenery question (Region 2) and a supplemental winter use question (Routt National Forest).

- Each of the issues outlined with opportunities for addressing the issue
- An appendix that tracks specific District concerns for each issue based on the district meetings

Subforest Scale Analyses

This forest scale analysis provides the framework for subforest site-specific analyses. During subforest scale roads analysis, the team should first review the watershed and wildlife risk assessments, including the risk assessment maps. This review will provide the forest context; it will help determine how roads may be affecting watershed health and wildlife habitat in the analysis area and help guide road-related decisions.

All classified and unclassified roads within the analysis area should be mapped and inventoried. The existing level 3, 4, and 5 road system map will help identify the roads system, but additional GPS field work may be necessary.

The team should then review, validate, and update the information in the road value versus risk matrix based on local knowledge of the level 3, 4, and 5 roads. Changes to the risk and values of these roads may result in changes to the road graph (see below) and the minimum level 3, 4, and 5 road system. The results of these road valuations can be used to develop road management alternatives for these roads, including relocation, upgrades, increasing or decreasing the maintenance levels, and possible decommissioning.

During Step 4 of the subforest scale analysis, the team should review the appropriate questions in Chapter 4 and provide additional site-specific information, as needed. For example, at the subforest scale, the economic questions can better assess road-related costs and benefits. The road risk versus value matrix provides annual and deferred maintenance costs by individual road to help assess road-related costs for economic analyses.

The team needs to ensure that all road-related decisions from subforest scale roads analyses are documented in Road Management Objectives (RMO) and that all INFRA and GIS databases are subsequently updated.

Please see Chapter 5 for a more detailed explanation of guidelines and use of the roads analysis results.

Key findings

In general, the existing maintenance level 3-5 road system, or the backbone road system, is adequate for existing and future management needs. Although some additional level 3-5 road construction may be needed to provide access for forest plan implementation, the existing backbone system provides the access needed for resource management and recreation use on the majority of the Forest.

Approximately half of the road system is considered high value and low risk, with the other half having high value and high risk; only a very small portion of the backbone road system (46 miles) was found to be low value. This suggests that the Routt National Forest has developed a road system to meet most of the access needs, although there are opportunities to reduce the resource impacts or annual and deferred maintenance costs.

Key findings related to specific issues addressed in this roads analysis are listed in the following table.

Issues, Opportunities, and Guidelines

Chapter 3 identifies forest scale issues that the Routt Roads Analysis addressed, and Chapter 5 integrates the issues with opportunities and guidelines to address them. The following table summarizes the issues from Chapter 3 and opportunities to address them. Specific concerns by Ranger District and opportunities and/or guidelines to address each issue are summarized in Appendix D.

Table 1. Issues and a summary of opportunities/guidelines, as well as Chapter 4 questions which address the issue.

Issue	Opportunity/Guideline	Ch. 4 Questions
1. Some roads may not be under the appropriate jurisdiction, and the right-of-way atlas may not reflect current jurisdiction.	Clarify current jurisdiction and update road atlas to reflect current jurisdiction. Once jurisdiction is clarified, identify roads where jurisdiction seems inappropriate. Work with counties etc. to transfer jurisdiction as needed; i.e., roads that access subdivisions. Require jurisdiction verification as part of subforest scale RAPs.	GT3, SI5, CH1-3
2. Road maintenance funding is not adequate to maintain roads and signs to standard.	Prioritize funding to address critical health, safety, and resource needs Reduce annual maintenance costs by correcting deferred maintenance work items. Ensure road maintenance level is adequate for access needs, and consider reducing maintenance level, where possible, to help reduce costs.	GT4, Chapter 2, EC1-3
3. Road access may not be adequate for future management needs.	Identify specific areas where road access is inadequate for resource management needs.	GT2, EF3-4, PT1, TM2-3

Issue	Opportunity/Guideline	Ch. 4 Questions
4. Rights-of-way across private land may not be adequate to access the forest as ownership and land uses change. Historic access across some of these lands is being closed off to the public. While this is not a change in legal status, it gives the appearance of shutting off large tracts of public land.	Identify right-of-way acquisition opportunities during all subforest scale RAPs. Communicate with county planning commissions regarding updated subdivision requests and land-use changes. Update the right-of-way atlas to help clarify legal access vs. historic use.	SU1, RR1, GT3, GT2
5. There are increased demands for year-round access across the Forest to private inholdings which may affect the road system and resources.	Develop a process for issuing special use permits for year-round use that takes into account effects to the road integrity, resources (wildlife etc), and changes in winter use patterns. There may also be additional safety concerns. To reduce wildlife impacts, consider allowing access only to the permittee.	WU1, GT2, GT3, SU1, SI1, AQ1-2, AQ4, TW1-4, UR/RR3, SI4-5
6. There are potentially adverse environmental impacts from the current road system. Roads causing adverse impacts should be prioritized for evaluation at the subforest scale.	Use the table which identifies watersheds with the highest risk for affecting resources to prioritize subforest scale analyses.	AQ 1-6, AQ8-12, AQ14, GT3, TW1-4, SI3
7. Higher road densities have greater potential to adversely affect resources and encourage illegal use.	Prioritize subforest scale analyses to focus on watersheds with the greatest risk to wildlife and watershed; then develop a process for inventorying unclassified roads and determining how they are to be managed.	AU2, GT4, AQ1-2, AQ4, AQ6, AQ9-10, AQ12, AQ14, TW1-4
8. Ineffective closures may have adverse affects on resources and can encourage illegal use.	When designing roads, consider future access needs and design the roads so that they can be effectively closed as needed. Consider the most appropriate closure method to meet objectives on a site-specific basis.	AU2, GT4, RR1-2, TW1-4
9. Management of the road system may be affecting big-game movement during hunting seasons.	Develop management strategies to reduce big game movement during hunting season. This may include temporary closures based on season or time of day.	TW2-3
10. Both off-highway vehicles (OHVs) and highway vehicles are used on the same roads and occasionally at the same time. This can be a safety problem.	Clarify which roads are open to OHVs depending on state, county, and Forest Service regulations. On roads open to OHVs where safety is a concern, develop a signing scheme to address safety concerns, and consider these roads as high priority for roadside clearing to improve sight distance.	GT4, WU1, AU2, RR1, SI5

Issue	Opportunity/Guideline	Ch. 4 Questions
11. Roads may be promoting illegal motorized use into wilderness areas.	Develop an education plan including signing at trailheads and community involvement.	GT3, AU2, UR/RR5, UR/RR7
12. Road management objectives (RMOs) are not current and need to be updated.	Develop a forest-wide strategy to review and update RMOs. Review and update of RMOs (with current line officer signatures) for any project affecting roads.	GT3-4, AU2

Additional key findings or comments related to the issues are listed below.

Recommendations

Chapter 5 identifies opportunities and guidelines for each issue, as well as for overall management of the road system. In reviewing the issues and opportunities in Chapter 5, there are some recurring themes. The following highlights some of these recurring themes and opportunities to address them.

- Current road funding is not adequate to maintain the existing road system. The Forest has identified some opportunities to reduce annual and deferred maintenance costs but needs to explore additional opportunities.
- Developing an effective education program would address several illegal use issues. The education program should include signing at strategic locations, as well as community oriented programs.
- Involve the appropriate specialists early in the process when addressing road-related issues. This includes engineers, lands specialists, and resources specialist. An integrated approach will reduce the impacts to resources, help maintain a current database, and ensure that all opportunities are considered.
- Identify issues and specific opportunities during subforest scale analyses. Develop a strategy to systematically conduct subforest scale analyses across the forest rather than analyzing on a project-by-project basis. This will provide for a more comprehensive approach to travel management planning.
- Several of the databases pertaining to roads are not current (i.e., RMOs, jurisdiction, and right-of-way atlas). Developing a process to update and maintain these databases would provide better information for subforest scale analyses.
- Changes in land uses for private lands adjacent to the Forest and private land inholdings are affecting legal and illegal access to the forest. This changing use can affect many resources including recreation use, wildlife security, and watersheds. Access objectives should be reviewed and updated to reflect the changing uses of the road system.

Chapter 1 Setting up the analysis

Background

In August 1999, the Washington Office of the USDA Forest Service published Miscellaneous Report FS-643 *Roads Analysis: Informing Decisions about Managing the National Forest Transportation System*. The objective of roads analysis is to provide decision-makers with critical information to develop road systems that are safe and responsive to public needs and desires, are affordable and efficiently managed, have minimal negative ecological effects on the land, and are in balance with available funding for needed management actions.

In October 1999, the agency published Interim Directive 7710-99-1 authorizing units to use, as appropriate, the road analysis procedure embodied in FS-643 to help land managers make major road management decisions. The Rocky Mountain Region of the Forest Service then published a roads analysis guidance document as a supplement to Appendix 1 of FS-643. This document provides guidance concerning the appropriate scale for addressing the roads analysis.

On March 3, 2000, the Forest Service proposed revising 36 CFR Part 212 to shift emphasis from transportation development to managing administrative and public access within the capability of the lands. The proposal was to shift the focus of National Forest System road management from development and construction of new roads to maintaining and restoring needed roads and decommissioning unneeded roads within the context of maintaining, managing, and restoring healthy ecosystems.

On January 12, 2001, the Forest Service issued the final National Forest System Road Management Rule. This rule revises regulations concerning the management, use, and maintenance of the National Forest transportation system. Consistent with changes in public demands and uses of National Forest System resources and the need to better manage funds available for road construction, reconstruction, maintenance, and decommissioning, the final rule removes the emphasis on transportation development and adds a requirement for science-based transportation analysis. The final rule is intended to help ensure that additions to the National Forest System road network are those deemed essential for resource management and use; that construction, reconstruction, and maintenance of roads minimize adverse environmental impacts; and that unneeded roads are decommissioned and restoration of ecological processes are initiated.

Process

Roads analysis is a six-step process. The steps are designed to be sequential, with the understanding the process may require feedback and iteration among steps over time as an analysis matures. The amount of time and effort spent on each step differs by project, based on specific situations and available information. The process provides a set of possible issues and analysis questions for which the answers can help managers make choices about road system management. Decision-makers and analysts determine the relevance of each question, incorporating public participation as deemed necessary. The following six steps guided the process.

Step 1. Setting up the analysis

Step 2. Describing the situation

Step 3. Identifying the issues

Step 4. Assessing benefits, problems and risks

Step 5. Describing opportunities and setting priorities

Step 6. Reporting—Chapters 1-5 of this report

Products

The product of an analysis is a report for decision-makers and the public that documents the information and analyses used to identify opportunities and set priorities for future national forest road systems. Included in a report is a map displaying the known road system for the analysis area, and the risks and opportunities for each road or road segment. A report may also include other maps and tables necessary to display specific priorities and changes in a road system.

The Forest Supervisor specifically asked the project team to provide the following information in this analysis report (10/8/02 internal memo):

- An inventory and map of all maintenance level 3, 4, and 5 (generally open to passenger cars) roads and a description of how those roads are to be managed.
- Guidelines for addressing road management issues and priorities related to construction, reconstruction, maintenance, and decommissioning.
- Significant social and environmental issues, concerns, and opportunities to be addressed in project level decisions.
- Documentation of the coordination efforts with other governmental agencies and jurisdictions.

This Report

This report documents the information and analysis procedure used for the Routt National Forest roads analysis. The report contains a table rating each road for recreation values, resource values, watershed risks, wildlife risks, and maintenance costs. It contains management guidelines and opportunities for future actions that will impact the Forest roads system. It also includes maps with the existing maintenance level 3, 4, and 5 road system, the potential minimum level 3, 4, and 5 road system, and maps of watershed risk, wildlife habitat, and the ROS.

Objectives of the Analysis

Establish the Level and Type of Decision-making the Analysis Will Inform

This forest scale roads analysis puts the road system into the context of forest resource management. In addition, this roads analysis will be used to support subforest scale and project level analyses. This analysis will:

- Include the effects of road management proposals on environmental and social issues.
- Evaluate transportation rights-of-way acquisition needs.
- Integrate with other non-Forest Service transportation systems (e.g., state and county roads).
- Explore the transportation investments necessary to implement the 1997 Routt Forest Plan and meet resource management goals and objectives.
- Assess the current and projected funding levels available to support road construction, reconstruction, maintenance, and decommissioning.

It is intended to identify and prioritize opportunities that address resource concerns and/or road maintenance. It will also be used to develop guidelines for implementing the 1997 Routt Forest Plan.

Identify Scale/Analysis Area

The analysis will:

- Be at the forest scale for the Routt National Forest (1.1 million acres) in northern Colorado, Region 2 of the National Forest System (see Figure 1).
- Concentrate on maintenance level 3, 4, and 5 roads, though levels 1 and 2 may be used for some specific resource analyses.
- Be spatial or Geographic Information System (GIS)-based whenever possible.
- Use only existing information.

Interdisciplinary Team Members and Participants

The Core Interdisciplinary Team and their specialties:

Liz Schnackenberg, Team Leader	Hydrologist	Supervisor's Office
Tony Smith	GIS Specialist	Supervisor's Office
Jena Hickey	Wildlife/TES Program Mgr.	Supervisor's Office
Ken Belcher	Forester	Parks Ranger District
Ann-Marie Verde	Transportation Planner	Supervisor's Office
Mary Sanderson	Recreation Specialist	Supervisor's Office
Diann Pipher	Public Affairs Specialist	Supervisor's Office

Extended team members and their specialties:

Leslie Horsch	Writer-Editor	Supervisor's Office
Kathy Foster	Fisheries Biologist	Supervisor's Office
Tommy John	Soil Scientist	Supervisor's Office
Joanne Sanfilippo	Archeologist	Supervisor's Office
Jeff Tupala	Landscape Architect	Supervisor's Office
Nina McElhinney	Lands Specialist	Yampa Ranger District
Heather Westfahl	Lands Specialist	Parks Ranger District
Tom Florich	Lands, Minerals, Special Uses	Supervisor's Office

Analysis Plan

The main analysis process considers all 468 miles of maintenance level 3, 4, and 5 roads under Forest Service jurisdiction in the Forest roads database. A two-step, integrated approach that considers issues, data, and information is used to systematically address all roads in a single analysis.

Step 1 considers the following:

Issues	Recreation use values.	Wildlife risk.
Road location.	Resource management values.	Watershed and Threatened, Endangered, and Sensitive (TES) aquatic species risk
Annual and deferred maintenance costs		

All of the items listed above are evaluated and assigned a low, medium, or high rating for each maintenance level 3-5 road. Recreation use and resource management are considered values of the road system. Watershed, wildlife, and maintenance costs are considered risks of the road system.

In Step 2, the value and risk ratings are each grouped into a single low, medium, or high rating. This results in each road having a set of descriptive coordinates that indicated their value and risk (e.g., high value, low risk). The descriptive coordinates are used to identify how the road system will be managed. The descriptive coordinates for each road are plotted on a graph; the four quadrants on the graph represent the following categories:

- Category 1 – High Value, Low Risk
- Category 2 – High Value, High Risk
- Category 3 – Low Value, High Risk
- Category 4 – Low Value, Low Risk

The results of this exercise are listed in the Road Management Category column in Appendix C – Road Matrix Table. High and low values and high and low risks are easy to plot into their associated quadrants. Medium values and medium risks are collected along an x-axis or y-axis and defaulted into the adjacent quadrant so that effectively no medium categories are possible in the final allocation (see Road Risk-Value Graph, page 95, for final results).

Once the roads are assigned to one of the four categories, recommendations for future actions are based on those four categories. This simplifies the final product and makes it possible to map the potential minimum road system.

Resource-specific analyses provide the data that appears in the Road Matrix (e.g., watershed risk, recreation use value) and the information to answer the questions in Chapter 4 – Assessing Benefits, Problems, and Risks.

Information Used

The following information sources were used for the analysis:

- Routt Travel Management Environmental Assessment.
- Social assessment for the 1997 Routt Forest Plan revision.
- Annual and deferred maintenance costs in INFRA.
- INFRA travel routes.
- Potential Public Forest Service Road (PFSR) project submittals, January 2001.
- Suitable Timber Base for the 1997 Routt Forest Plan revision.
- Roadless area inventory for the 1997 Routt Forest Plan revision.
- Range of Natural Variability assessment for the 1997 Routt Forest Plan revision.
- Economic assessment for 1997 Routt Forest Plan revision.

The IDT utilized the following Geographic Information System (GIS) data:

- Roads (all).
- 6^{th}-level watersheds.
- Streams and riparian areas.
- Geological hazards.
- Soil map units.

- Management Area prescriptions.
- Recreation Opportunity Spectrum (desired condition from 1997 Routt Forest Plan).
- Developed recreation sites.
- Land status.
- Occurrence of TES aquatic species.
- Research Natural Area and Special Interest Area maps from 1997 Routt Forest Plan revision.
- Colorado Natural Heritage database.
- Beetle risk.
- Fire management units.

Public Involvement

Communications Plan

There was concern about the possibility of public confusion on what this forest scale Roads Analysis Process was and was not. Since the process would not involve an action proposal resulting in a decision, it would be difficult to collect public input at the forest scale. The following strategy was used to obtain meaningful public involvement; the full Communications Plan and summary of comments is listed in Appendix J.

The tone of the communication effort was low-key, informative, and aimed at stakeholders with a direct and meaningful interest in National Forest System roads. This was appropriate for three main reasons: 1) this is not a NEPA analysis requiring a legally mandated level of public scoping and involvement (that will come later, when road-specific decisions are made), 2) this effort was completed in seven months, necessitating an adequate, but not over-done, public involvement effort, and 3) numerous public scoping efforts related to road and travel management have preceded this analysis. An adequate base of knowledge about public issues already exists and was used to identify opportunities.

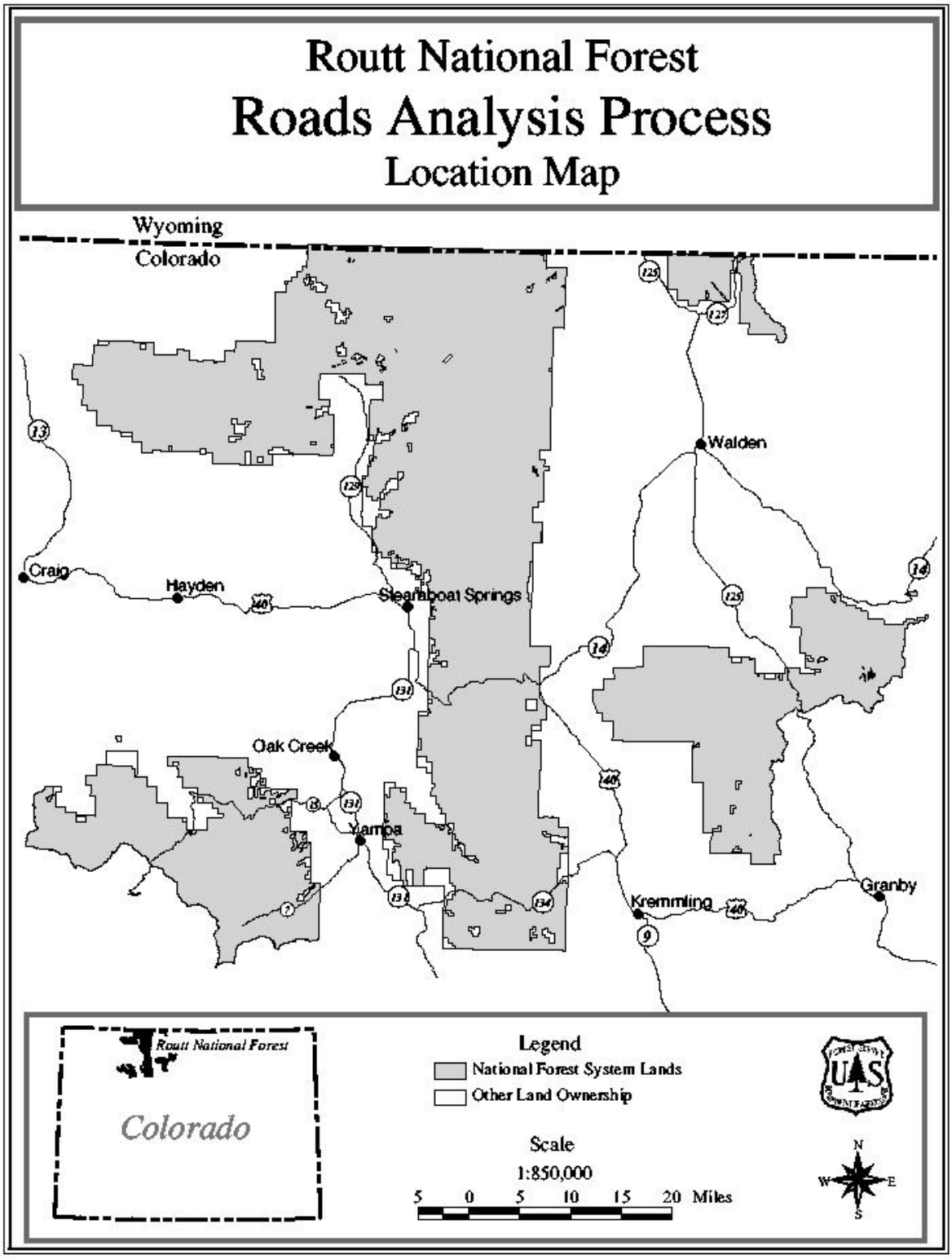
The Communications Plan for this assessment identified the County Commissioners and County Road and Bridge Superintendents as the key contacts. In general, the commissioners and road and bridge superintendents are the county representatives who have the actual road management knowledge and information useful in identifying mutual (county and Forest Service) opportunities and issues.

Public Contacts

From December 2002 through February 2003, Hahns Peak-Bears Ears District, Parks District, and Yampa District employees contacted County Commissioners and Road and Bridge Superintendents from Jackson, Grand, Routt, Rio Blanco, Garfield, and Moffat counties. Some of these were formal contacts, with the District Ranger making presentations at Commissioner meetings. Some were more informal, with the District Ranger and/or Forest Transportation Engineer making contacts with individual Commissioners or Road and Bridge Superintendents. Forest Service representatives explained the roads analysis process and discussed mutual road-related issues and potential opportunities.

All of the counties asked for copies of the final roads inventory and map developed through this process. The counties were particularly interested in future road closures and requested continued involvement when there are proposals to close roads. Notes from these meetings are summarized in Appendix J.

Figure 1. General location map.



Chapter 2 Describing the situation

The Analysis Area

Understanding the Routt National Forest

The Routt National Forest occupies a unique setting in northwest Colorado. The Forest is between two internationally recognized destination sites—Rocky Mountain National Park and Dinosaur National Monument. The Continental Divide follows the Park Range from the Wyoming border to Rabbit Ears Pass through the northern Troublesome Range to Rocky Mountain National Park. Portions of the Forest are within the boundaries of Garfield, Grand, Jackson, Moffat, Rio Blanco, and Routt counties. Denver is the nearest metropolitan center, located approximately 150 miles southeast of Steamboat Springs.

Physical Environment

The Routt National Forest has 1,125,568 acres (GIS) of National Forest System land. The Routt also administers an additional 113,832 acres of Arapaho National Forest lands. Approximately 20% of the Routt National Forest is designated wilderness.

The Forest has diverse topography consisting of high plateaus, rolling foothills, and mountains. Precipitation amounts and patterns vary greatly due to the topographic differences. Measured average precipitation ranges from 10 inches east of the Continental Divide at Walden to 67 inches on the Continental Divide near Buffalo Pass. The climate can be summarized by the statement "long, snowy winters and short cool summers." Elevations exceed 12,000 feet in some areas.

The north-south Park Range and its southern extension, the Gore Range, split the Forest near its center. The Flat Tops, a series of high-elevation plateaus, are located in the southwest portion of the Forest. In the northwest are the Elkhead Mountains. Separating North Park from Middle Park is the east-west Rabbit Ears Range. The Medicine Bow Range forms the boundary of the Forest in the northeast. The southeast boundary is formed by the Williams Fork Mountains and the Front Range. The headwaters of the North Platte River and the Yampa River originate entirely on the Forest. The Middle Park area feeds into the upper Colorado River.

Recent events have impacted portions of the Forest. In 1997, a wind event blew down approximately 13,000 acres of trees in the Park Range. The fires of 2002 burned over 37,000 acres in the Flat Tops, Gore, and Park Ranges. These combined events amounted to 4 % of the Forest.

Biological Environment

The Routt National Forest lies within two ecological sections—the North Central Highlands Section and the Northern Parks and Range Section. About 78% of the Forest is classified as forested. Most of the forested land is composed of spruce/fir, lodgepole pine, and aspen. Most of the Forest (60%) is in a mature condition. The nonforested land makes up about 22% of the Forest. It includes grassy meadows, shrubs such as sagebrush and oakbrush, and rock/talus slopes.

The Forest provides habitat for over 300 wildlife and fish species. These include common species such as deer, elk, and rainbow trout and less common species such as pine marten, goshawk, and Colorado River cutthroat trout.

Social and Economic Environment

People and communities are tied to the Forest in many ways. Forest management is of concern to people living in communities near the Forest, as well as those using the Forest. Proximity to forest resources, such as scenery, wildlife, and clean water, is what makes many communities adjacent to the Forest desirable places to visit and live.

People are part of the ecosystem. The inclusion of human dimension in ecosystem management recognizes that people's needs, uses, and attitudes affect all forest resources. The human objective in ecosystem management can be defined as "seeking to understand human demands on, values and perceptions of, and interactions with ecosystems and to integrate those into policy, programs, and management."

Managing ecosystems on a sustainable basis means weighing all the components to produce what people value, while not pre-empting the options of future generations. Under an ecosystem management approach, outputs are produced to meet society's needs, but emphasis is placed on ecological processes and functions and ecosystem capabilities, sustainability, and health.

For the past 20 years, economics have been changing from a long-term dependence on agriculture and, in some cases, mining to a high degree of dependence on recreation and tourism. The 1990 Farm Act authorized the Forest Service to help rural communities identify ways to diversify their economies. The Routt National Forest has provided assistance, through rural development grants, to the towns of Kremmling and Walden.

Recreation

The Forest offers a wide variety of recreation opportunities, with an emphasis on dispersed recreation. There are 260,000 acres of designated wilderness and additional 500,000 inventoried roadless acres. There are 922 miles of trails, most of which are available to hikers, horseback riders, and mountain bikers. Over half of the 1,603 miles of roads are open to motorized public use. There are several developed campgrounds and trailheads. A world-class ski area is located on the forest system lands just outside the town of Steamboat Springs. Other major recreational activities include hunting and snowmobiling.

Locatable Minerals

Locatable minerals are those valuable deposits subject to exploration and development under the Mining Law of 1872 and its amendments. Approximately 35% of the Forest can be classified as having a high-to-moderate potential for locatable minerals.

Leasable Minerals

Currently, three wells are in production on the Forest. However, extensive oil and gas activity has occurred on lands adjacent to the Forest. Exploration and development for oil and natural gas is expected to increase over the coming years.

Timber Production

The supply and demand from the Routt National Forest cannot be assessed without taking into account the supply and demand from other forests in the timbershed. A study for the 1997 Routt Forest Plan revision (Rideout and Stone 1992) found the Forest was supplying timber below the demand level. However, conditions on the Routt National Forest have changed since Rideout's and Stone's study. Recent events, including the Routt Divide Blowdown and beetle infestation, may increase timber supply.

Livestock Grazing

Permits are required for livestock grazing on the Forest. During the past 10 years, the numbers have fluctuated annually depending on economics and weather. In 1993, 10,700 head of cattle and 49,700 head of sheep grazed on the Forest. This is 83% and 69%, respectively, of the maximum number permitted.

Special Forest Products

The forest plan allows the gathering or collection of special forest products, such as herbs, mushrooms, rocks, small trees and shrubs, floral products, etc. on a case-by-case basis. Permits to collect these products are available from the Ranger Districts, upon request.

The National Forest Transportation System

General Description

The transportation system on the Routt National Forest serves a variety of resource management and access needs. Most roads on the Forest were originally constructed for commercial access purposes, including grazing, timber, and mineral extraction. Others resulted from construction of water storage and transmission projects for municipal water supplies. Over the past 100 years, an extensive road network has been developed and continues to serve commercial, recreation, and administrative purposes and provide access to private lands.

There are currently 1,603 miles of inventoried, classified[1] National Forest System (NFS) roads on the Routt National Forest transportation inventory. The three Ranger Districts, Yampa, Hahns Peak/Bears Ears (HPBE), and Parks, share management of the road system. The Colorado counties of Garfield, Grand, Jackson, Moffat, Rio Blanco, and Routt have roads that are within or provide access to the National Forest.

Twenty-nine percent (468 miles) of the NFS roads are managed and maintained for public use with low-clearance vehicles (passenger cars). These roads receive the highest traffic and are the most costly to maintain to standard. They are the focus of this forest scale roads analysis.

NFS roads are maintained to varying standards depending on the level of use and management objectives. There are five maintenance levels (also referred to as levels) used by the Forest Service to determine the work needed to preserve the investment in the road. These maintenance levels are described in *FSH 7709.58 – Transportation System Maintenance Handbook*. Levels 3, 4, and 5 provide access for passenger car traffic and make up the backbone of the Forest transportation system. The following table summarizes the miles of level 3 through 5 roads under Forest Service jurisdiction.

[1] Classified roads are wholly or partially within or adjacent to NFS lands that are determined to be needed for long-term motor vehicle use, including state roads, privately owned roads, NFS roads, and other roads authorized by the Forest Service.

Table 2. Inventoried maintenance level 3, 4, and 5 roads (USFS jurisdiction) by Ranger District (miles).

Maintenance Level	Yampa	Hahns Peak / Bears Ears	Parks	Forest Total
3	88	72.0	110	270.0
4	28	86.0	82	196.0
5	0	1.5	0	1.5
Total	116	159.5	192	467.5
	25%	34%	41%	100%

The remaining 1,132 miles of inventoried NFS roads are either restricted to motor vehicle traffic use (maintenance level 1) or managed only for high-clearance vehicles such as pickup trucks and four-wheel drive vehicles (maintenance level 2). These roads are single-purpose, low-volume roads, normally single-lane and unsurfaced.

The definition of jurisdiction has been subject to different interpretations over the years, which has led to some inconsistent entries in the INFRA database. "Jurisdiction is the legal right to control or regulate use of a transportation facility derived from fee title, an easement, an agreement, or other similar method. While jurisdiction requires authority, it does not necessarily reflect ownership" (FSM 7705). This analysis will focus primarily on roads under Forest Service jurisdiction. Roads under other jurisdictions will be included where they are needed to show the connection to the National Forest System Roads (NFSR).

Unclassified[2] roads on National Forest System lands are identified in the field during project analysis. The majority of these roads have been created by off-road vehicle traffic. The Routt National Forest does not have a current inventory of unclassified roads. They are generally identified during project level analyses.

Meeting Forest Plan Objectives

Among the national objectives for the transportation system (FSM 7702) are:

1. To provide sustainable access in a fiscally responsible manner to National Forest System lands for administration, protection, and utilization of these lands and resources consistent with forest plan guidance.
2. To manage a forest transportation system within the environmental capabilities of the land.
3. To manage forest transportation system facilities to provide user safety, convenience, and efficiency of operations in an environmentally responsible manner and to achieve road related ecosystem restoration within the limits of current and likely funding levels.

By reference, this manual direction is also part of the forest plan.

[2] Unclassified roads are roads on NFS lands that are not managed as part of the Forest transportation system (unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail, and those roads that were once under permit or other authorization and were not decommissioned upon termination of the authorization).

The forest plan set forth the following monitoring questions related to roads:

- Are outputs of goods and services being produced at a rate consistent with the projections in the Supplemental Table S-2 of the FEIS (report annually, evaluate every five years)?
- Are costs of implementing programs occurring as predicted in the Supplemental Table S-3 of the FEIS (evaluate every five years)?

The Supplemental Table S-2 has the following outputs to monitor: road maintenance, road construction, road reconstruction, and road decommissioning. The following is a summary of the miles projected in the FEIS and the actual accomplishments.

Table 3. FEIS projected road miles (experienced budget level) and actual accomplishments (1998-2002).

Activity	Projected Miles in 1997 FEIS at Experienced Level	Actual Accomplishments (average from 1998-2002)
Roads maintained (about 1/3 or 500 miles are maintained on a 3-yr cycle)	1,448 miles	500 miles
Road construction	9.3 miles/year	3.3 miles/year
Road Reconstruction	5.2 miles/year	6.1 miles/year
Road decommissioning	18.4 miles/year	9.0 miles/year

Source: Forest Monitoring and Evaluation Report (note: "roads maintained" does not include deferred maintenance needs).

The majority of the planned new construction would consist of local roads. Arterial and collectors are the roads used to provide primary access to large portions of the National Forest. Arterials normally serve as connections between towns, major county roads, or state highways and are main thoroughfares through the Forest. Collectors link large areas of the Forest to arterials or other main highways. Little new construction of the arterial and collector system is anticipated.

Projected road construction and reconstruction have not been met for the first five-year period of the plan. Declining timber sales and reduced capital investment programs are the primary reasons for not meeting forest plan expectations.

A review of the existing road maintenance levels by functional class is shown below. Updating the Road Management Objectives (RMOs) to reflect the current and objective use of the road can help prioritize road maintenance funding.

Table 4. Inventoried maintenance levels of Forest arterial and collector roads (miles).

Maintenance Level	Arterial	Collector	Local
1	0	79	521
2	4	117	414
3	35	170	65
4	111	73	12
5	0	1.5	0
Total Miles	**150**	**440.5**	**1012**

Source: Infra database

Federally Designated Forest Highways and Scenic Byways

The analysis area contains two Forest Highways designated under the Public Lands Highways program of the Transportation Equity Act for the 21st Century (TEA21). These routes are state, county, or Forest Service-owned roads qualifying for federal funding for improvement or enhancement. They provide access to and within the National Forest. The Dunckley Pass Road is also a designated National Scenic By-way. These roads are listed in the following table:

Table 5. Federally designated Forest Highways.

Forest Hwy Number	Route Name	Description of Termini	County	Length (miles)
16	Marvine-Phippsburg (Dunckley Pass)	Phippsburg – Forest boundary	Routt/Rio Blanco	34.2
20	County 129 – Hahns Peak	U.S. 40 – Wyoming border	Routt	51.6

Forest Highway funding can be used for planning, design, and construction or reconstruction of these designated routes. Other work can include parking areas, interpretive signing, acquisitions of scenic easements or sites, sanitary and water facilities, and pedestrian and bicycle paths.

Work is currently in the planning stage for upgrades to Forest Highway 16 (Dunckley Pass Road). One of the identified needs for this road is to transfer jurisdiction to Rio Blanco County by granting an easement.

Budget

The Forest budget allocation for planning, construction, and maintenance of roads has been averaging $2,000,000 per year from 1997 to 2002 for the combined Forests. Based on miles of road, the proportion for the Routt National Forest would average around $560,000, including planning costs. However, the annual cost to maintain the entire road system to standard is considerably higher than the amount allocated by Congress. In prior years, congressionally appropriated road funding was supplemented by road construction and maintenance work performed by timber purchasers through the commercial timber sale program. This program has declined steadily and is a mere fraction of the program of a decade ago.

From 1998 through 2002, the Forest conducted road condition surveys to determine the actual cost of maintaining the road system to standard. Work items were also recorded to determine the cost of road maintenance deferred in previous years due to lack of funding. Finally, road improvement work necessary to bring the roads up to the desired objective was identified and documented. Analysis of the data collected showed that the Forest is substantially under-funded for the size of the road system it manages (see table below).

Table 6. Summary of needed funds for road maintenance and operations.

Maint. Level	Total Miles	Annual Maintenance		Deferred Maintenance		Capital Improvements	
		$/mile	Total $	$/mile	Total $	$/mile	Total $
1	600	600.07	360,042	50.12	30,072	0	0
2	535	757.65	405,343	856.70	458,334	0	0
3	270	4,924.10	1,329,506	32,214.56	8,697,932	626.86	170,882
4	196	5,598.94	1,097,392	36,539.84	7,161,808	1,402.10	275,232
5	1.5	9,129.33	13,694	548	822	149,771.81	224,658
Total	**1,602.5**		**3,192,283**		**16,348,146**		**670,772**

Source: Forest INFRA Condition Surveys as of January 2003.

The experienced budget level from the forest plan is projected at $840,000 per year. Desired condition budget level was projected as $1,193,000. Historic budget for the road program in the last five years has roughly been about $560,000. Due in large part to this funding shortfall, there is a need to identify and prioritize the potential minimum road system necessary for access to and management of the National Forest.

Routt, Grand, Jackson and Rio Blanco counties have signed agreements to perform portions of certain maintenance functions on Forest Service roads. The work performed by the counties contributes to the annual road maintenance accomplishments for the Forest. The counties are funded to perform this work through State of Colorado allocations of the Highway User Gas Tax receipts. The following table displays the current mileage of roads under the jurisdiction of the Forest Service being maintained by county organizations.

Table 7. Miles of road on the Routt National Forest roads (maintenance level 2-4) being maintained by counties.

	Miles Maintained		
County	**Maintenance Level 2**	**Maintenance Level 3**	**Maintenance Level 4**
Grand	17.5	94.6	
Jackson	41.7	101.6	8.6
Rio Blanco		5.7	13.3
Routt	28.9	77.2	

Chapter 3 Identifying issues

Identifying Issues

Issues were identified by the Interdisciplinary Team (IDT) and Districts and through public involvement. The IDT developed a list of preliminary issues and discussed them with each district. Following the meetings with the districts and counties, issues were determined to either be forestwide and therefore carried forward or more limited in scope and not carried forward. Evaluation of the standard questions, plus the Routt winter use question, in Chapter 4 identifies the effect each issue has on different resources and the opportunities or guidelines to address these issues. Chapter 5 uses information from Chapter 4 to explain the issue and summarizes opportunities by issue.

Issues carried forward

1. Some roads may not be under the appropriate jurisdiction, and the right-of-way atlas may not reflect current jurisdiction.
2. Road maintenance funding is not adequate to maintain roads and signs to standard.
3. Road access may not be adequate for future management needs.
4. Rights-of-way across private land may not be adequate to access the forest as ownership and land uses change. Historic access across some of these lands is being closed off to the public. While this is not a change in legal status, it gives the appearance of shutting off large tracts of public land.

5. There are increased demands for year-round access across the Forest to private inholdings, which can affect the road system, resources, and winter use patterns.
6. There are potentially adverse environmental impacts from the current road system. Roads causing adverse impacts should be prioritized for evaluation at the subforest scale.
7. Higher road densities have greater potential to adversely affect resources and encourage illegal use.
    a. Higher road densities may promote illegal use of existing unclassified roads, which may increase road densities by the creation of new unclassified roads and additional illegal use. This occurs because some users view old roadbeds as access to backcountry areas and use them even if they are closed.
    b. Higher road densities, including unclassified road density, have higher potential for adversely affecting resources.
        - High road densities, especially roads open to motorized vehicles, may be fragmenting habitat for some species, degrading the quality of big game hunting, creating conflict between nonmotorized and motorized users, and affecting watershed health.
8. Ineffective closures can result in illegal use (see issue above), which can then have adverse effects on resources.
9. Use of the road system may be affecting big-game movement during hunting seasons.
10. Small all-terrain vehicles (ATVs) and highway vehicles use the same roads, occasionally at the same time. This can be a safety problem.
    a. Roads that transition from one jurisdiction to another have inconsistent regulations governing the use of ATVs. This creates confusion for the public users and for law enforcement personnel.
11. The location of some roads may be promoting illegal motorized use into wilderness areas.
12. Road management objectives (RMOs) are not current and need to be updated.

Issues not carried forward

Some issues were identified through the District meetings but were not carried forward as forestwide issues. The following summarizes these issues and the reasons for not being carried forward.

1. Connections from USFS to other state and federal lands are not adequate.

   Disposition: In general, road connections are adequate between USFS and other state and federal lands. There may be opportunities to improve trail connections between USFS and other state and federal lands, but road connections appear to be adequate.

2. There is not enough legal public access to the forest. This may promote illegal activities such as unauthorized outfitting.

   Disposition: After discussions between the Districts and IDT, the issue should be reworded to "Private landowners adjacent to, or within, National Forest System lands are assuming exclusive access to the Forest. This may be promoting illegal outfitting from private lands." This rewording illustrates that this is an enforcement issue regarding illegal outfitting and access rather than an issue directly associated with the road system. The other aspects of this issue are covered under number four above.

3. The standard of roads newly constructed for single-entry silvicultural purposes and managed as restricted use, may be too high.

   Disposition: Districts are already consciously building roads only to the standard necessary to meet access needs while protecting resources. This is inherent in good transportation planning and is not a forestwide issue.

4. There is inadequate parking for winter use.

   Disposition: This issue does not specifically pertain to the road system, although it is associated with it. The issue is covered in part under number six (above) as inadequate parking can result in resource concerns. This issue should be considered during subforest scale analyses. There may be opportunities to utilize existing roads to accommodate additional parking needs.

5. Members of the public often do not understand why permittees etc. are allowed to use restricted roads for maintenance purposes etc., while they are not.

   Disposition: This is a public perception issue. USFS manual and handbook direction define when and for what purposes exceptions are made. The 1997 Routt Forest Plan outlines authorized purposes for administrative access.

6. The policy for the use of restricted roads for administrative purposes is not consistent across the forest.

   Disposition: Using restricted roads for administrative purposes depends on the individual line officer and the reasons for why the road is restricted. The road management objectives should include pertinent information and consistent documentation; issue number 12 above partially addresses this.

Chapter 4 Assessing benefits, problems, and risks

Introduction

The September 10, 2002 version of the R-2 Roads Analysis Supplement to FS-643 provided the guidelines for this step. This guideline document provides direction and suggestions for different scales for each question. The IDT used the overall guidance provided, but decided to answer most of the questions at the forest scale to provide background information for each question for referencing and citing purposes during subforest scale roads analyses. This analysis should reduce time for project level planning.

Current Road System Benefits, Problems, and Risks

Aquatic, Riparian Zone, and Water Quality (AQ)

Analysis of the aquatic questions in this forest scale roads analysis focuses on identifying watersheds where there is a high risk of watershed function and/or aquatic species being affected by the road system. This will help prioritize those watersheds on which to focus subforest analyses. For this reason, all inventoried roads were considered, including all roads (maintenance levels 1-5). Looking at all of the roads allowed a broad scale assessment of the risk to watershed function associated with the entire road system rather than just the

arterials and collectors. The broad forest scale analysis provides the basic framework for watershed or project level analyses. Subforest scale analyses will identify site-specific areas being affected by the road system and opportunities to address these concerns.

Map analysis was used to determine which level 3-5 roads are at the highest risk of affecting watershed function and aquatic habitat. These roads are identified in the road matrix.

AQ1: How and where does the road system modify the surface and subsurface hydrology of the area?

The hydrology of the Routt National Forest is snowmelt dominated. This means that effects to the surface and subsurface hydrology occur mostly during spring runoff and major thunderstorm events. Both the road system itself, and management of the road system including snowplowing, affects the surface and subsurface hydrology.

Roads expand the channel network, convert subsurface flow to surface flow, and reduce infiltration on the road surface. All of these factors affect the overall hydrology in a watershed, particularly the quantity and timing of flow.

The channel network is expanded by road ditches, which create stream channels in previously unchannelized portions of the hillside. Road ditches also intercept subsurface flow and convert it to surface flow. An expanded channel network augments peak flows since water traveling as concentrated surface flow reaches the channel faster than water traveling as subsurface flow (Wemple et al. 1996). Reduced infiltration contributes to additional surface flow since water does not infiltrate for storage in the soil profile, but rather runs off as overland or surface flow. Storage and movement of water through the soil profile as subsurface flow regulates and sustains baseflows. When roads disrupt these processes, more water becomes available during peak flows, and less water is available to sustain baseflows.

While the effects of roads on the hydrology of an area depend largely on local factors, road density is an indicator of the road system's relative potential for modifying surface and subsurface hydrology; the higher the road density, the greater the potential for the road system to affect the hydrology. Road density was calculated for each 6th-level watershed, and watersheds were classified as having high, medium, or low potential for hydrological effects based on relative road densities (see Appendix A – Watershed Risk Assessment). Road density was subdivided into the density of maintenance level 1-2 roads and the density of maintenance level 3-5 roads. The assumption is that the level 3-5 roads receive regular maintenance and are generally not significantly affecting the aquatic resources.

Level 1-2 roads receive less maintenance and generally less use. As a result, these roads have a higher potential of inadequate or improperly maintained drainage, and problem areas may go unnoticed. Many level 1-2 roads were built between 1950-1970 and did not incorporate Best Management Practices (BMPs). For this reason, it was assumed that the level 1-2 roads have the greatest potential for affecting aquatic resources; this assumption is consistent with field reconnaissance. The aquatic specialist report identifies the range of values that represent the low, moderate, and high ratings for road densities as well as other parameters used in questions AQ 1-4, AQ 6, and AQ 9.

The following table summarizes the ratings by major river basin for each factor. The first number indicates the number of watersheds with a high, moderate, and low rating for that category, and the second number indicates percent of the 6th-level watersheds in that river basin with that rating; the last row summarizes the entire Routt National Forest.

Table 8. Summary of potential road impacts and sensitive soils by major river basin.

River Basin	Risk rating	Road density level 1-5		Road density level 1-2		Road Xing density level 1-5		Road density within 200' of streams		% of watershed with sensitive soils		Road density on sensitive soils level 1-5	
		#	%	#	%	#	%	#	%	#	%	#	%
North Platte	H	4	12	1	3	2	6	6	19	4	13	8	25
32 watersheds	M	14	44	11	34	9	28	10	31	10	31	2	6
	L	14	44	20	63	21	66	16	50	18	56	22	69
Colorado R.	H	4	21	0	0	1	5	2	11	6	32	3	16
19 watersheds	M	8	42	8	42	4	21	8	42	11	58	6	32
	L	7	37	11	58	14	74	9	47	2	10	10	52
Yampa River	H	3	6	1	2	1	2	5	9	35	65	16	30
54 watersheds	M	5	9	4	7	5	9	20	37	14	26	7	13
	L	46	85	49	91	48	89	29	54	5	9	31	57
Little Snake River	H	0	0	1	10	1	10	3	30	6	60	7	70
10 watersheds	M	6	60	1	10	4	40	3	30	2	20	1	10
	L	4	40	8	80	5	50	4	40	2	20	2	20
TOTAL RNF	H	11	9	3	3	5	4	16	14	51	44	34	30
115 watersheds	M	33	29	24	20	22	19	41	36	37	32	16	14
	L	71	62	88	77	88	77	58	50	27	24	65	56

The following is a list of opportunities/recommendations for roads that significantly modify the surface and subsurface hydrology:

- Design roads to minimize interception, concentration, and diversion potential.
- Design measures to reintroduce intercepted water back into slow subsurface pathways.
- Use outsloping and drainage structures to disconnect road ditches from stream channels rather than delivering water in road ditches directly to stream channels.
- Evaluate and eliminate diversion potential at stream crossings.

The unrestricted use of roads during wet weather and winter can result in rutting and churning of the road surface. Runoff from such damaged road surfaces carries a high sediment load. The damage and maintenance cycle for roads that are frequently used in winter can create a disturbed road surface that is a continuing source of sediment. Snowplowing can affect spring runoff processes by developing berms on the edges of the road prism which trap and concentrate water on the road surface rather than allowing water to flow across the road prism. This further reduces dispersed flow of water down the hillside and increases the concentrated surface flow which reaches the channel faster than subsurface flow.

The following are opportunities for minimizing the effects of winter snowplowing on hydrological processes:

- Consider surfacing measures such as rocking, armoring, or paving to protect the integrity of the road surface.
- Construct and maintain breaks in snow berms created by snowplowing to allow water to drain off the road.
- Consider soil type and slope steepness when spacing breaks in the snow berm; do not locate snow berm breaks on steep areas or in areas with erosive soils.
- Do not locate snow berm breaks at relief culvert locations, as this will add to water already being concentrated by the road surface and road ditches.
- Mark culvert locations prior to snowfall, and then keep culverts and ditches functional during and after plowing operations.

Issues addressed: 5, 6, and 7

AQ2: How and where does the road system generate surface erosion?

Surface erosion is highly dependent on soils, road surfacing, road grade, age of the road, traffic volumes, and the effectiveness and spacing of drainage structures. The greatest surface erosion problems occur in highly erodible terrain, particularly landscapes underlain by granitic or highly fractured rocks (USFS 2000). Studies have found that sediment delivery to stream systems is highest in the initial years after road construction, although raw ditchlines and road surfaces with little binder can remain chronic sources of sediment.

Drainage structure, function, and spacing are key to minimizing the amount of surface flow, which directly affects surface erosion. The Water Conservation Practices Handbook (FSH 2509.25) provides guidelines for spacing drainage structures. Drainage structures should be close together on silt-sand soils with little to no binder on steep slopes, but can be further apart on gravel road surfaces with moderate binder and little to no fines on flat or minimum grades.

To evaluate surface erosion potential, the percent of each watershed with soils having high surface erosion potential or that are highly erodible were considered (see Appendix B – Sensitive Soils Analysis). Soils with high surface erosion potential are on steeper slopes where slope is the driving factor. Highly erodible soils have physical characteristics with a high soil erodibility factor (K factor) that makes them susceptible to erosion even on flat slopes. The two extremes of highly erodible soils include shales with high clay content and decomposed granite which has no binder. The analysis of these two soil types constituted the inherent erosion risk for each watershed.

The potential for the road system to generate surface erosion was based on the miles of road on sensitive soils (Appendix B – Sensitive Soils Analysis); these miles of road were then summarized, and each watershed was determined to have a high, medium, or low risk of water quality effects from surface erosion. The density of road-stream crossings and the density of road miles within 200 feet of a stream were used as secondary indicators of the potential for eroded materials to be delivered to the stream system.

The previous table summarizes the soil risk factors by major river basin. Forty-four percent of the watersheds have sensitive soils in over 50% of the watershed area. However, only 30% of the watersheds have high risk ratings for roads located on sensitive soils. This indicates that, when locating roads, the Forest has been successful at avoiding sensitive soils where possible.

The primary opportunities to reduce surface erosion identified in a subforest scale roads analysis include:

- Increasing the number and effectiveness of drainage structures.
- Improving the road surface by either gravelling or adding a binding material to roads that have native surfaces with no inherent binder.

Snowplowing can further increase the potential for surface erosion by concentrating dispersed flow on the road surface as described under AQ 1. Opportunities to reduce the effects of snowplowing on surface erosion are similar to those described under AQ1 with the following additions:

- Require equipment used to plow snow to have shoes or runners, which keep the blade a minimum of two inches above the road surface.
- Allow use of the road only during dry or frozen conditions to minimize rutting.

Issues addressed: 5, 6, and 7

AQ3: How and where does the road system affect mass wasting?

Road-related mass wasting results from 1) improper placement and construction of road fills and stream crossings, 2) inadequate culvert sizes to accommodate peak flows, sediment loads, and woody debris, 3) roads located on soils prone to mass wasting, and 4) water diversion onto unstable hillslopes.

The sensitivity of an area to mass wasting depends on the interaction of the soils and underlying bedrock, slope steepness, and the subsurface hydrology. Approximately one third of the 6th-level watersheds on the Routt National Forest are susceptible to high or moderate mass movement potential over 50% or more of the watershed (Appendix B). Project-level analyses should address mass wasting areas when considering new road construction.

Subforest scale analyses provide the opportunity to identify areas where the interaction of the soils, underlying bedrock, slope steepness, and subsurface hydrology are creating high priority concern areas. This forest-scale analysis helps identify watersheds where additional road construction may cause mass wasting. Opportunities to address existing roads in areas with mass wasting potential include:

- Road relocation to an area with more stable soils.
- Relocation of drainage structures so that the outlets are on less sensitive areas which may include flatter slopes and locations with better-drained soils.

Issue addressed: 6

AQ4: How and where do road-stream crossings influence local stream channels and water quality?

Road-stream crossings have the potential to directly and indirectly affect local stream channels and water quality. Poorly designed crossings directly affect hydrologic function when they constrict the channel, are misaligned relative to the natural stream channel, or when improperly sized culverts are installed. Road-stream crossings also act as connected disturbed areas where water and sediment are delivered directly to the stream channel. Connected disturbed areas are defined as "high runoff areas like roads … that discharge surface runoff into a stream or lake … connected disturbed areas are the main source of damage in all regions" (FSH 2509.25-99-2).

The density of road-stream crossings in each 6th-level watershed was used to determine those watersheds where road-stream crossings pose the highest risk to local stream channels and water quality. The results are summarized in Table 8. Watersheds were determined to have a high, medium, or low priority for further evaluation through subforest scale roads analyses (see Appendix A).

Opportunities to improve concern areas include:

- Design crossings to pass all potential products including sediment and woody debris, not just water.
- Realign crossings that are not consistent with the channel pattern.
- Change the type of crossing to better fit the situation; for example, consider bridges or hardened crossings on streams with floodplains, and consider bottomless arch culverts in place of round pipe culverts.
- Add cross-drains near road-stream crossings to reduce the connected disturbed area.
- Reduce the number of road-stream crossings to minimize the potential for adverse effects.

On roads where snowplowing occurs, plowing snow directly into the stream channel at road-stream crossings could result in the development of ice-dams. These ice-dams reduce channel capacity and the ability to convey water. This can result in culvert failure and/or cause channel migration as water is forced out of the channel and around the ice-dam. Channel migration can result in the development of a braided channel since areas outside the channel may not be resistant to the erosive forces of water.

Opportunities to address road-stream crossings where snowplowing occurs include:

- Mark all culverts prior to snowfall. Ensure that the culverts are open and functioning throughout the winter and at the beginning of spring snowmelt.
- Remove all snow fills and restore the natural stream crossing on any low-water crossing prior to spring snowmelt to prevent the development of ice-dams.

Issues addressed: 5, 6, and 7

AQ5: How and where does the road system create potential for pollutants, such as chemical spills, oils, deicing salts, or herbicides, to enter surface waters?

The potential for pollutants to reach stream channels occurs wherever roads run adjacent to, or cross, streams or floodplains. Mechanisms for pollutant transport to a stream system include direct input into surface water (usually from spills) or runoff from snowmelt or rainfall. Most of the level 3, 4, and 5 roads are in proximity to a waterway at some point. The proximal point may only be at a bridge crossing, or perhaps the road parallels the channel for some distance.

Forest-administered roads at greatest risk for accidental spills are those used for management activities such as timber harvesting, oil and gas development, and snowmobiling (where snowmobiles are stored and maintained on site). Log haulers and other heavy equipment associated with harvest and road activities carry sufficient fuel and oil to cause localized water quality problems should an accident occur. This is minimized by stipulations in timber sale contracts that specify haul speeds, fueling practices, weather or road moisture limitations, and other aspects of the operations. Forest road maintenance crews are also trained to utilize safe areas and procedures for refueling heavy equipment. The potential for pollutants associated with log haulers would be highest on those roads commonly used for timber harvest access, particularly maintenance levels 3-5 roads. The potential risk of accidental spills lessens as use of the road decreases.

Due to heavy commercial traffic, chemical and oil spills have the greatest chance of occurrence along U.S. Highway 40 (US 40) over Rabbit Ears Pass. The stream systems at the greatest risk are those which US 40 crosses, including Grizzly Creek, Muddy Creek, Walton Creek, and Harrison Creek and tributaries to each of these streams. A 1997 petrochemical spill affected groundwater quality on the east side of Rabbit Ears Pass. Recent monitoring indicates that the effects to water quality have dissipated but still exceed water quality standards.

Spills related to snowmobiles, ATVs, and motorcycles most often occur during refueling, frequently at trailheads. The greatest risk on the Routt National Forest is adjacent to FSR 60 near Dry Lake Campground

where the Blue Sky West Powder Cats operation refuels snowcats as part of their daily winter operation and on US 40 at snowmobile parking lots.

During the winter, magnesium chloride (MgCl) is applied regularly as a de-icing agent on US 40 over Rabbit Ears Pass. When de-icing salts are used, the frequency of applications is generally higher, and the chemicals do not bind with the soils (or pavement in the case of de-icing). For these reasons, the use of these salts for de-icing purposes has a higher potential for affecting water quality than use of salts for dust abatement.

Concerns regarding the application of magnesium chloride include reduced water quality and aquatic biota impacts from chlorides and trace metals. According to an evaluation of de-icers (Fischel 2001), chloride de-icers have a relatively low toxicity to fish and aquatic invertebrates. However, this report also recommends further evaluation of acute toxicity concentrations of de-icers on fish and invertebrates.

A recent study on I-70 in near the Eisenhower Tunnel in Colorado found that the use of magnesium chloride for de-icing is highly unlikely to cause adverse effects to water quality or aquatic organisms at distances greater than 20 yards from the highway (CDOT 1999). A similar study along I-70 on the west side of Vail pass found a substantial increase in chloride concentrations below the highway where deicing salts were used relative to control streams, but the concentrations were still within state water quality standards (Lorch 1998).

While no specific information was gathered to compare the application rates and frequency of de-icing on US 40 as compared to I-70, it is a reasonable assumption that both frequency and application rates are equal or higher on I-70 and that the results from the I-70 study should be applicable to the Routt National Forest. Highways on which de-icing salts are used would have the highest risk of affecting water quality, but these effects are generally localized, do not exceed water quality standards, and become diluted as the salts move downstream through the system. The location and use of US 40 poses a high risk of magnesium chloride reaching those stream systems it crosses because the material acts as a film over the asphalt surface and is easily washed into the drainages during snowmelt or rain.

The Forest annually applies magnesium chloride as dust abatement on National Forest Roads 550, 400, 60, and 900 through agreements with Routt County. Magnesium chloride is also applied on main roads during timber sales where dust and/or road maintenance is a problem; the applications harden an unsurfaced road thereby reducing the need for maintenance.

The application of magnesium or calcium chloride for road dust abatement may affect water quality, but past studies have found that the effects can only be detected after many years of repeated, year-round application (Heffner 1997). Unlike its use as a de-icer on paved roads, magnesium chloride as a dust abatement measure is less likely to be transported by runoff into a stream channel or body of water because it adheres to the road surface. During application, however, spillage into surface waters adjacent to a road can occur. Typically, magnesium or calcium chloride is only applied 1-2 times per year on roads requiring it (generally, maintenance level 4 and higher roads). This factor should be considered when upgrading the maintenance level to 4 or higher. This may be a concern in areas where aquatic threatened, endangered, and sensitive species are present. For road upgrades that would attract more traffic and possibly require dust abatement or road hardening, the Forest should consider the cumulative and potential water quality impacts of materials such as magnesium chloride.

Roads create the potential for the spread of noxious weeds. As such, control of noxious weeds along roads located near streams and water bodies presents a risk of the herbicide reaching surface water.

Issue addressed: 6

AQ6: How and where is the road system "hydrologically connected" to the stream system? How do the connections affect water quality and quantity?

To answer this question, we evaluated hydrologic connectivity and assigned a risk rating for each watershed and for each road segment.

Watershed risk: The road system is hydrologically connected to the stream system through an extended channel network (see AQ1) and where there are connected disturbed areas (see AQ2 and 4). This includes road-stream crossings, as well as areas where roads are adjacent to stream courses and there is an insufficient buffer strip between the road or road drainage structures and the stream system. As discussed in AQ1, the extended channel network can increase peak flows. As discussed in AQ4 and 5, water quality can be degraded where connected disturbed areas increase sediment and/or pollutant delivery to the stream system. Connected disturbed areas on sensitive soils (high surface erosion potential, highly erodible soils, high or moderate mass movement potential) are the most likely to deliver sediment to the stream system. The miles of road within 200 feet of a stream course were used as an indicator of the potential for hydrologic connectivity. A risk rating was assigned based on this potential:

- High risk – watersheds with five or more miles of road within 200 feet of a stream course.
- Moderate risk – watersheds with one to four miles within 200 feet of a stream course.
- Low risk – watersheds with less than one mile within 200 feet of a stream course.

Road risk: The road matrix identifies the potential risk of each maintenance level 3-5 road for being hydrologically connected and affecting watershed health and aquatic species. Professional judgment, knowledge of specific roads, and GIS maps were used to determine if a road or segment of road had an overall high, moderate, or low risk of being hydrologically connected.

- High risk: A substantial portion of the road segment (50% or greater) runs immediately adjacent to a stream so that it is hydrologically connected, or there are known problem areas.
- Medium risk: 20-50% of the road segment was immediately adjacent to the stream system, or a high percent of the road segment was on sensitive soils, or knowledge of a potential or isolated problem area.
- Low risk: Less than 20% of the road segment was immediately adjacent to the stream system, little to no part of the road segment was on sensitive soils, and there were no known problems.

For aquatic species, the road was given a high rating if it directly affected aquatic TES habitat, a moderate rating if it has the potential to affect TES habitat, and no rating if there were no TES aquatic species near the road.

All the factors identified in AQ 1-4, and AQ 9 were used to develop an overall watershed risk rating (see Appendix A). The overall risk rating represents the potential for hydrologically connected areas which can affect both water quality and water quantity. A second overall watershed risk rating was developed for watersheds with Colorado River native cutthroat trout (CRN); these watersheds were considered more sensitive to the effects of roads. The following table identifies the number of 6th-level watersheds by major river basin with a high risk of the road system affecting overall watershed function, and those watersheds with only moderate ratings from a road standpoint that were upgraded to high risk due to the presence of CRN.

Table 9. Sixth-level watersheds by major river basin with overall high risk ratings.

River Basin	Total number of 6th-level watersheds	6th level watersheds with overall high risk ratings		6th level watersheds with overall high risk ratings when considering CRN presence	
		#	%	#	%
North Platte	32	6	19	6	19
Upper Colorado	19	4	21	5	26
Yampa	54	5	9	13	24
Little Snake	10	5	50	7	70
RNF Total	115	19	17	30	26

Watersheds with high-risk ratings would be the priority for subforest scale analysis. Analysis at this smaller scale would identify site-specific problem areas and opportunities for reducing the effects of the road system on water quality and quantity, and aquatic habitat. The following table identifies watersheds with a high risk rating due to physical factors: road density for both level 1-5 roads and level 1-2 roads only, density of road-stream crossings, miles and/or density of roads within 200 feet of stream channels, and miles of road on sensitive soils. Each factor was rated and given a value: high = 3, moderate = 2, low = 1. Watersheds with ratings greater than 10 were considered high risk.

Table 10. Watersheds with a high risk of roads affecting watershed function based on physical factors.

6th-level HUC	Watershed Name	Drainage Area (mi^2)	Total Risk Rating
North Platte River Basin			
101800010102	Arapahoe Ck	38.41	11
101800010103	Coyote Ck	4.16	12
101800010201	Illinois River Headwaters	58.41	12
101800010204	Willow Ck	26.73	12
101800010703	Pinkham Ck	15.97	12
101800010501	Little Grizzly/Doran Cks	17.75	12
Colorado River Basin			
140100011204	Corral Ck	15.40	12
140100011406	Red Dirt Ck	23.90	11
140100011407	Pass/Burke Spring/Sheep Cks C	13.27	11
140100012202	Upper Rock Ck	41.83	13
Yampa River Basin			
140500010105	Reed Ck	13.93	14
140500010107	Upper Willow Ck	27.39	13
140500010305	North Hunt Ck	11.46	11
140500010307	Lawson Ck	5.84	12
140500010401	Oak Ck	9.00	11
Little Snake River Basin			
140500030101	Little Snake River-Whiskey Ck	49.98	11
140500030102	King Solomon Ck	48.93	11
140500030204	Willow Ck-Spring Ck	5.36	11
140500030301	Upper Slater Ck	32.57	11
140500030501	Upper Fourmile Ck	2.59	15

A second overall risk rating was developed for watersheds where Colorado River native cutthroat trout (CRN) were present. Based on the occurrence of a TES species, these watersheds were considered more sensitive to the effects of roads even if the physical factors alone did not place them in the high risk category.

Table 11. Watersheds upgraded to a high risk rating due to the presence of CRN.

6th level HUC	Watershed Name	Drainage area (mi^2)	Total risk rating with CRN	Risk rating without CRN
Colorado River Basin				
140100011402	Muddy/Milk Cks	32.86	12	9
Yampa River Basin				
140500010101	North Fk Elk River	41.13	11	8
140500010106	Lower Willow Ck	25.56	11	8
140500010108	Elk River at Glenn Eden	16.27	11	8
140500010302	Lower Bear River C	22.86	11	8
140500010307	Lawson Ck	5.84	12	12
140500010501	Trout Ck	23.86	11	8
140500010601	Elkhead Ck	46.01	12	9
140500010703	Cottonwood Ck	2.28	11	8
140500011203	Poose/Rough Cks	22.90	11	8
Little Snake River Basin				
140500030105	South Fk Little Snake River	22.42	11	8
140500030301	Upper Slater Ck	32.57	14	11
140500030302	Middle Slater Ck	33.00	11	8

Opportunities to address concern areas identified in subforest scale analyses are the same as in AQ1-4. Additional opportunities include relocating roads adjacent to stream channels to a position higher on the hillslope away from streams.

Issues addressed: 6 and 7

AQ7: What downstream beneficial uses of water exist in the area? What changes in uses and demand are expected over time? How are they affected or put at risk by road-derived pollutants?

Downstream beneficial uses of water in the area are identified by the Colorado Department of Public Health and Environment under Regulation No. 31 (5 CCR 1002-31). They include:

- Recreation (Class 1 – Primary Contact; Class 2 – Secondary Contact).
- Agriculture.
- Aquatic life (Class 1 – Cold Water Aquatic Life; Class 1 – Warm Water Aquatic Life; Class 2 – Cold and Warm Water Aquatic Life).
- Domestic water supply.
- Wetlands.

Under Colorado's Regulation No. 31, the highest level of water quality protection applies to waters considered "outstanding" state or national resources. All waters within wilderness areas managed by the Forest are designated as outstanding.

An intermediate level of protection applies to waters not designated outstanding or use-protected. These waters fall under the anti-degradation review process and must be maintained and protected at their existing

quality, unless the state determines that lower water quality is necessary for important economic or social development. Except for stream segments designated as outstanding, all of the stream segments on the Forest fall under the anti-degradation review process.

Changes in classification and designated uses sometimes occur over time as knowledge of certain water bodies increases or as stakeholders petition the Colorado Water Quality Control Commission. Classifications can be either upgraded or downgraded through this public process with commensurate changes in protected designated uses.

Demands for most water uses are on the rise. With increases in population, public and private lands recreation, agriculture, and industry, controversy over appropriate uses of water will continue to grow.

None of the streams in the Routt National Forest are listed as impaired on the Colorado 303(d) list (CDH, 2002). However, there are 23 stream segments on the monitoring evaluation list (M&E list) for potential impairment due to sediment. Streams are placed on this list when there are reasons to suspect water quality problems, but uncertainty exists regarding one or more factors. The following table identifies 6th-level watersheds with streams on the M&E list and the overall watershed risk associated with roads for each watershed.

Table 12. Streams on the Colorado monitoring and evaluation list by 6th-level watershed and road-related risk.

6th Level HUC	6th-level watershed	Stream Name	Road-related watershed risk
101800010101	Grizzly Cr headwaters, Little Grizzly Cr/Doran Cr	Grizzly Cr and Little Grizzly Cr	Moderate
101800010201	Illinois River Headwaters	Snyder Cr	High
101800010104	Buffalo Creek	Grassy Run	Moderate
101800010502	Arapahoe Cr	Ninegar Cr	High
101800010502	Newcomb Cr	Newcomb Cr	Low
101800010602	Republic Cr	Republic Cr	Moderate
101800010703	Pinkham Cr	Pinkham Cr	High
140100011204	Corral Cr	Corral Cr	High
140100011406	Red Dirt Cr	Smith Ditch	High
140100012202	Upper Rock Cr	Little Rock Cr	High
140100012202	Upper Rock Cr	Gore Creek	High
140100011402	Muddy/Milk Cr	Muddy Cr	Moderate
140500010601	Elkhead Cr	First Cr	High
140500010305	North Hunt Cr	Spronks Cr	High
140500030302	Middle Slater Cr	S.Fk. Slater Cr	Moderate
140500010407	Fish Cr	Puppy Dog Cr	Moderate
140500010901	Morrison Cr	Muddy Cr	Moderate
140500010901	Morrison Cr	Bushy Cr	Moderate
140500010106	Lower Willow Cr	Beaver Cr	Moderate

6th Level HUC	6th-level watershed	Stream Name	Road-related watershed risk
140500030105	S. Fk. Little Snake River	S. Fk. Little Snake	Moderate
140500030105	S. Fk. Little Snake River	Johnson Cr	Moderate
140500030105	S. Fk. Little Snake River	Oliver Cr	Moderate
140500030101	Little Snake R.- Whiskey Cr	Silver City Cr	High

Those watersheds with streams on the M&E list and with high road risk ratings should be the priority for evaluating the effects of the road system on watershed function and identifying opportunities to improve water quality through road-related projects.

AQ8: How and where does the road system affect wetlands?

Roads can affect wetlands directly by encroachment and indirectly by altering hydrologic surface and subsurface flow paths. Encroachment results in a loss of wetland area directly proportional to the area disturbed by the road. Alteration of the hydrologic flow paths can affect wetland function with the effects extending beyond the area directly affected by the road. The Watershed Conservation Practices Handbook (FSH 2509.25) provides measures to protect wetlands.

During project-level analyses, opportunities to reduce the effects of the road system on wetlands include the following:

- Relocate roads out of wetland areas.
- Where relocation is not an option, use measures to restore the hydrology of the wetland. Examples include raised prisms with diffuse drainage such as french drains.
- Set road-stream crossing bottoms at natural levels of wet meadow surfaces.

AQ9: How does the road system alter physical channel dynamics, including isolation of floodplains, constraints on channel migration, and the movement of large wood, fine organic matter, and sediment?

Roads can directly affect physical channel dynamics when they encroach on floodplains or restrict channel migration. Floodplains help dissipate excess energy during high flows and recharge soil moisture and groundwater. Floodplain functions are compromised when roads encroach on, or isolate, floodplains, and this can increase peak flows. When peak flows increase, more water is available for in-channel erosion, which, in turn, affects channel stability. Restricting channel migration can cause channel straightening which increases the stream energy available for channel erosion; this can also result in channel instability. Altering channel pattern affects a stream's ability to transport materials, including wood and sediment.

The miles of road within 200 feet of a stream course were used as an initial indicator of where the road system might be affecting physical channel dynamics. These concerns are greatest on reaches with floodplains where the streams naturally meander, which are typically lower gradient reaches. Table 8 summarizes the number of watersheds with high, moderate, or low risk of the road system affecting channel dynamics; Appendix A lists the rating for each watershed.

Issues addressed: 6 and 7

AQ10: How and where does the road system restrict the migration and movement of aquatic organisms? What aquatic species are affected and to what degree?

Migration and movement of aquatic organisms are primarily restricted at road-stream crossings with culverts. Generally, the restriction is on upstream migration, although downstream migration can also be affected. This results from hanging culverts, high flow velocities in culverts, and inadequate depths for fish migration. In

some locations, migration barriers are desirable to protect native species. While culverts can affect the migration of amphibian species, the greatest concern is the effect on fish species. Many resident fish species migrate upstream and downstream during their life cycle seeking a variety of aquatic habitats, which might include spawning, rearing, or hiding habitat. Although these migrations may be less than a mile, they can be very important for the long-term survival of the species and maintenance of the population.

We evaluated the potential for migration barriers associated with maintenance level 1-2 roads by identifying those watersheds that contain cutthroat trout and have high road-stream crossing densities. These watersheds would be considered high priority for site-specific analysis at the subforest scales. Opportunities to address problem crossings include:

- Reset the culvert to eliminate the limiting factor.
- Replace the culvert with an alternative crossing such as bridge, hardened low-water ford, or bottomless arch culvert.

Of the approximately 168 culverts evaluated in 9 of 27 geographic areas, about 62 (37%) have been identified as potentially creating aquatic species passage problems.

Issues addressed: 6 and 7

AQ11: How does the road system affect shading, litterfall, and riparian plant communities?

The road system directly affects riparian communities where it impinges on riparian areas. Roads can indirectly affect riparian communities by intercepting surface and subsurface flows and routing these flows so that riparian areas dry up and the riparian vegetation is replaced with upland vegetation. Riparian communities play a vital role in providing shade. Removal or degradation of these communities can affect stream stability and water temperatures which, in turn, affect aquatic habitat. The Watershed Conservation Practices Handbook (FSH 2509.25) provides measures to protect riparian areas.

Anecdotal information indicates that the interior of culverts can provide local hiding cover for trout, particularly at low flows. Culverts are generally not considered a significant source of hiding cover unless the riparian communities, which typically provide shading and hiding cover, have been significantly degraded.

Opportunities to address concern areas found in watershed or project level analyses include:

- Relocate roads out of riparian areas.
- Restore the hydrology in riparian areas that have been dewatered by the road system.

Issue addressed: 6

AQ12: How and where does the road system contribute to fishing, poaching, or direct habitat loss for at-risk aquatic species?

High traffic roads adjacent to streams with fish are the most likely to contribute to fishing and poaching. Poaching is not generally considered an issue on the Routt National Forest and does not significantly affect aquatic populations and at-risk aquatic species.

The road system contributes to direct habitat loss where mass movements associated with roads directly impact stream channels (AQ3), where sediment is delivered directly to the stream channel through connected disturbed areas (AQ6), at road-stream crossings (see AQ4), and where the road system is restricting channel migration and isolating floodplains (see AQ9). Areas of particular concern are watersheds with Colorado River cutthroat trout populations identified as having high-risk potential in AQ3, AQ4, AQ6, and AQ9. Opportunities to address problem areas would be similar to those previously identified.

Roads often create barriers to water flow and root propagation, which can indirectly result in alterations to adjacent plant communities; this has the potential to indirectly affect amphibian habitat (Loeffler 2001). Soil compaction, soil and landform disturbances, and reduced live root systems associated with road construction

alter the local hydrology, thus indirectly affecting amphibians and their habitat. Another indirect effect of roads comes from fragmentation of amphibian populations, which ultimately results in population losses given a prolonged period of isolation.

Issues addressed: 6 and 7

AQ13: How and where does the road system facilitate the introduction of non-native aquatic species?

The introduction of non-native species occurs primarily through stocking of non-native fish. The Colorado Division of Wildlife coordinates stocking locations with the Forest Service to ensure that non-native aquatic species are not being introduced into waters containing native fish species or waters that provide high quality habitat for native species reintroduction. Known stocking locations include any lake or major stream that a stocking truck can drive to. Primary stocking locations are Hahns Peak Lake on the Hahns Peak/Bears Ears Ranger District, Big Creek Lake on the Parks Ranger District, and Bear Lake on the Yampa Ranger District; however, there are many other locations where roads facilitate stocking. High mountain lakes and other hard-to-access areas are stocked by airplane.

In addition to known stocking areas, introduction of non-native aquatic species could occur at any location where the road system crosses a stream or wet area and sufficient habitat exists to support a species long enough for it to migrate to a more desirable habitat. The road system may also provide a mechanism for other invasive aquatic species to become established. Current concerns focus on invasive aquatic plants such as Elodea that may be moved from water to water on boats or other equipment. The current road system indirectly contributes to the spread of diseases such as whirling disease and chytrid fungus by providing access to streams and wet areas. Waders or other fishing equipment used in an infected water body, then used in a different water body can transfer these diseases if they are not properly cleaned; this is more likely to occur in areas with road access. Whirling diseases could potentially wipe out populations of cutthroat and rainbow trout and the chytrid fungus could do the same to boreal toads and other amphibian species.

AQ14: To what extent does the road system overlap with areas of exceptionally high aquatic diversity or productivity or areas containing rare or unique aquatic species or species of interest?

The road system generally has moderate overlap with areas of exceptionally high aquatic diversity or aquatic species of interest. The primary species of interest include Colorado River cutthroat trout and western boreal toad. Watersheds containing cutthroat trout and sensitive amphibian species are identified in Appendix A. Those that have a high risk of resource damage associated with roads and containing sensitive aquatic populations would be a priority for more detailed watershed- or project-level analyses.

This analysis also identified specific level 3-5 roads which were close to streams with sensitive species populations and may be affecting these populations (see Appendix C – Road Matrix Table).

Issues addressed: 6 and 7

Terrestrial Wildlife (TW)

TW1: What are the direct and indirect effects of the road system on terrestrial species habitat?

Direct Effects

The general direct effects of roads on wildlife include habitat loss, population isolation, edge effects, and habitat fragmentation.

Habitat loss

Road construction removes previously existing vegetation from the road prism. Therefore, the construction of roads usually results in a loss of habitat for those wildlife species that sought food or shelter in the vegetation prior to removal.

On the Routt National Forest, the road system equates to a loss of 2,710 acres of marten habitat, 2,547 acres of red-backed vole habitat, 1,449 acres of golden-crowned kinglet habitat, and 744 acres of lynx habitat (denning and/or winter foraging). The following table compares the estimated acres of habitat available to each of these species to the acres of habitat lost due to the presence of the road system. Taken alone, the impact of habitat loss compared to habitat available is minute for all of these species. However, the following effects of roads on wildlife illustrates that the presence of roads can have numerous adverse impacts on various wildlife species far beyond direct habitat removal.

Table 13. Acres of habitat impacted by roads and road-edge effects.

Acres	Marten	Red-backed vole	Golden-crowned kinglet	Lynx
Habitat Available on the Routt NF	482,409	451,968	274,388	393,466
Habitat Lost to Roads on Routt NF	2,710 (0.6%)	2,547 (0.6%)	1,449 (0.5%)	744 (0.2%)
Acres of Edge Effect	41,987 (9%)	39,366 (9%)	22,052 (8%)	28,854 (7%)

Population isolation

For species with low mobility, certain kinds of roads impede the movements of individuals, thereby reducing their ability to disperse, mate, or otherwise interact. Roads with more traffic and larger road prisms are more apt to isolate populations than smaller, low-use roads. Such a barrier to movement equates to a barrier to gene flow and splits one larger population of interbreeding individuals into two or more smaller populations. These smaller, isolated populations are then at risk of remaining viable (Gaines et al. 1997).

The two main risks to an isolated population are a reduced gene pool and reduced resiliency to demographic stochasticity. A population with reduced genetic variation suffers from a reduced capacity to respond to environmental changes that occur over time. In addition, isolated populations cannot absorb natural population fluctuations (stochasticity) as easily as larger, contiguous populations can. Whether the population fluctuates up or down, an isolated population also has an isolated area of habitat to support it. If conditions cause an increase in individuals, the smaller isolated area cannot accommodate the needs of the increased population as easily as a larger contiguous area. When conditions change for the worse, the isolated population is at risk of declining to zero rather than declining and then recovering.

On the Routt National Forest, the road system may be isolating populations of boreal toad (Loeffler et al. 2001), cutthroat trout (Kruse et al. 2001), tiger salamander (Gibbs 1998), red-backed vole (Mills 1995), meadow vole (Gaines et al. 1997), montane voles (Gaines et al. 1997), and snakes (Rudolph and Burgdorf 1997). Of the 115 sixth-level watersheds on the Routt National Forest, 88 have level 1-2 roads and 74 have level 3-5 roads intersecting amphibian habitat. For those watersheds in which roads intersect with amphibian habitat, there is an average of 0.63 miles/mile^2 of level 1-2 roads and 0.61 miles/mile^2 of level 3-5 roads within amphibian habitat. Across the entire Forest, there are 2,552 road/stream crossings within potential amphibian or fish habitat. Such crossings can, and often do, isolate amphibian and/or fish populations. The following table shows the density of level 3-5 roads in riparian habitat for high (>0.5 mi/mi^2) and medium (0.25>med>0.5 mi/ mi^2) risk watersheds.

Table 14. Watersheds at risk of population isolation of aquatic species by level 3-5 roads and the associated road density within riparian habitat.

High Risk	Mile/Mile^2	Medium Risk	Mile/Mile^2
North Fork Big Creek	0.58	Bear River Headwaters	0.27
Red Dirt Creek	0.62	South Fake Elk River	0.28
Corral Creek	0.63	Middle East Fork Williams Fork C	0.29
East Fork Encampment River	0.63	Republic Creek	0.32
Elk River at Glenn Eden	0.65	Little Snake Tennessee-Tennessee Creek	0.32
King Solomon Creek	0.68	Fish Creek	0.33
Chimney Creek	0.69	Grizzly Creek Headwaters	0.33
Lower Morrison Creek C	0.74	Middle Fork Elk River	0.35
Blacktail Creek	0.85	Newcomb Creek	0.35
Arapahoe Creek	0.87	Upper Slater Creek	0.37
Pass/Burke Spring/Sheep Creeks C	0.91	Soda Creek	0.37
Little Snake River-Whiskey Creek	0.92	Trout Creek	0.38
Muddy/Milk Creeks	0.94	Rock Creek	0.39
Willow Creek	0.95	Upper Muddy Creek C	0.40
Upper Willow Creek	0.95	Middle Slater Creek	0.42
Illinois River Headwaters	0.98	Walton Creek	0.44
South Fork	0.98	Elkhead Creek	0.46
Lower Bear River C	0.98		
South Fork Big Creek	1.07		
Reed Creek	1.14		
Oak Creek	1.18		
Coyote Creek	1.27		
Dutch Gulch/Frantz Creeks	1.30		
Toponas Creek	1.33		
Little Grizzly/Doran Creeks	1.34		
Upper Rock Creek	1.58		
Upper Fourmile Creek	1.60		
Pinkham Creek	1.65		
Cottonwood Creek	1.67		
Camp Creek	1.93		
Mill Creek	1.98		
Middle Creek	2.60		

Edge effects

Some wildlife species are affected not only by the habitat loss incurred by the road system, but also by the altered environment within a certain distance of the road system. This altered forested environment along an edge offers different microclimatic conditions (Vaillancourt 1995) and reduced security from predators for certain wildlife species compared to an interior forested environment (Chen 1992, Vaillancourt 1995). The barren characteristic of a road allows increased light, wind, rain, and visual penetration into the forested environment bordering the road. The visual penetration results in a greater predation risk to animals in forested ecosystems. This risk is described in more detail below in the Indirect Effects section of Question TW1.

The relationship of wildlife to edge is complex because certain wildlife species experience edge effects only within relatively short distances from the edge where other species experience edge effects relatively far from the edge. The response of a single species to an edge feature may vary depending on the cover type, density of vegetation, percent canopy cover, and other variables in the environment bordering on the road (or other edge feature). For instance, a densely forested cover type would allow light, wind, and rain to penetrate a shorter distance than a sparsely forested cover type would. In general, a sparse forest would have a larger edge effect around its roads than a dense forest would.

Vaillancourt (1995) measured edge effects for several variables (i.e. canopy cover, sunlight intensity, and stem density) on the Medicine Bow National Forest and generally found thresholds of effects at distances between 30-50 meters from the edge. Impacts were still measurable deeper into the forest, but there were not enough sites greater than 70 meters from an edge for an adequate sample size. Additional research demonstrated edge effects more than 240 meters into the forest (as summarized in Baker 2000). Assuming a conservative estimate of a 100 meters edge effect, the road system on the Routt National Forest impacts 41,987 acres of marten habitat, 39,366 acres of red-backed vole habitat, 28,854 acres of lynx winter-foraging habitat (and therefore, snowshoe hare habitat), and 22,052 acres of golden-crowned kinglet habitat (see Table 13).

Habitat fragmentation

Certain wildlife species experience negative impacts not only from the loss of habitat, but also from the perforation of their habitat. Such animals might overcome some habitat removal by increasing their home range to include additional suitable habitat but, at some point, the home range would become too large and the habitat too fragmented for individuals of the species to persist in the affected area. The fragmentation of their habitat means the individual animals must travel longer distances and burn more calories to seek prey and shelter. Territorial species may be limited in how much they can enlarge their territory because neighboring individuals of the same species will defend their boundaries, thus thwarting a given individual's efforts at home range expansion. Fragmentation also forces animals to travel in open areas where they are more vulnerable to predation risk.

On the Routt National Forest, the road system fragments the habitat of martens, lynx, small mammals such as red-backed voles, and amphibians.

Indirect Effects

Roads indirectly impact wildlife by increasing the presence of edge species (both plant and animal) and reducing habitat effectiveness.

Increases in edge species

On the Routt National Forest, the road system is a vector for the spread of Canada thistle (*Cirsium arvese*), ox-eye daisy (*Leucanthemum vulgare*), chamomile (*Anthemis spp*), and musk thistle (*Carduus nutans*). The impacts of such noxious weeds on wildlife are described under Question EF2 of this document. In addition to increases in edge-associated plants, the roads on the Routt National Forest provide an avenue by which edge-associated birds and mammals can penetrate an otherwise interior forest environment. These generalist species (e.g. jays, crows, red-tailed hawks, great horned owls, coyotes, foxes, and bobcats) elbow out interior habitat specialists. Although the addition of edge-dwelling species may increase the overall number of species in a given area (species richness), that addition often reduces the abundance of habitat specialists (Beauvais 1997, Anderson et al. 1977). Furthermore, habitat generalists tend to be numerous and well distributed across their range whereas habitat specialists are more prone to rareness or sensitivity (Goerck 1997).

Edge-associated generalists reduce the abundance of interior habitat specialists by both direct predation and competition. When near roads, species such as the red squirrel and the snowshoe hare are more vulnerable to avian predators like red-tailed hawks that would not typically forage in a closed forest canopy. Furthermore, the edge effects from roads nullify the competitive advantage of certain habitat specialists (marten and lynx on the Routt National Forest) by allowing habitat generalists access to what would normally be forest interior. Marten and lynx possess adaptations to travel through structurally complex forest and/or deep snow in order to out-compete habitat generalists like the great horned owl, coyote, and bobcat. Thus, the presence of roads on the Routt National Forest affects marten (sensitive species) and lynx (threatened species) by artificially reducing the quality of their habitat and increasing their competitors' available habitat.

Reduced habitat effectiveness

Roads can reduce habitat effectiveness in several ways, some of which were described above in Question TW1. In addition to edge's contribution to reduced habitat effectiveness, the activities associated with roads often disturb wildlife, thereby reducing habitat effectiveness. Disturbance can result in stress and displacement of animals (Cassirer et al. 1992, Ferguson and Keith 1982, Freddy et al. 1986), nest abandonment (Knight and Cole 1991), and interruption of breeding behavior (Boyle and Samson 1985). Constant disturbance can result in changes in behavior, abandonment of territory (Anderson et al. 1990, Knight and Cole 1991), and even death of animals (Leptich and Zager 1991). Disturbance can result from any one, or combination, of the following: foot traffic, motorized and nonmotorized vehicles, horseback riders, hunters, or logging activities and can occur both on and off road. These human activities are described in more detail in Question TW3 below.

Some species avoid crossing roads and thereby experience a direct reduction in their available habitat. Species that do not avoid crossing roads are more prone to vehicle collisions. Baker and Knight (2000) demonstrated that forest carnivores (e.g., marten and lynx) are especially vulnerable to road mortality because they have large home ranges that often include road crossings. With the exception of high-use roads, lynx do not appear to avoid roads (Ruggeiro et al. 2000). Occasional road-kill lynx mortalities have been documented on highways in many locations across North America (summarized in Ruediger et al. 2000). Moreover, significant numbers of highway-kill lynx mortalities were associated with translocated individuals during efforts to reintroduce lynx to portions of their historic range. An on-going lynx reintroduction effort near the Routt National Forest likely will result in a higher risk of collision-related lynx mortality, especially on highways. Marten mortalities caused by collisions with logging trucks have been observed on the adjacent Medicine Bow National Forest (O'Doherty, pers. comm. 01/22/2003).

Compared to more mobile species, forest roads pose a greater hazard to small, slow-moving, migratory animals, such as amphibians, making them highly vulnerable as they cross even narrow forest roads (Langston 1989). Most species of reptiles lay on roads to thermo-regulate and, in doing so, many of them are killed by vehicles (Vestjens 1973). Amphibians and reptiles on the Routt National Forest include the boreal toad, tiger salamander, wood frog, northern leopard frog, and the smooth green snake. Based on the road density in their potential habitat, amphibians in the following watersheds, Middle Creek, Mill Creek, Cottonwood Creek, Pinkham Creek, Upper Fourmile Creek, and Upper Rock Creek, are at greatest risk to road mortality (see Table 14).

Wildlife species that are sensitive to disturbance do best if they have security areas (Hillis et al. 1991). These areas are blocks of land that have very limited human traffic and provide shelter and food. The optimal size of the blocks depends on the species in question, the habitat quality, the site's topography, and other factors. Hillis et al. (1991) defined security areas for elk as non-linear blocks of hiding cover at least 250 acres in size and more than one-half mile from any open road. This definition is broad enough to encompass the needs of most other habitat generalists on the Routt National Forest. There are 104 elk-security areas, totaling 472,200 acres (738 miles^2), on the Routt National Forest that satisfy these habitat-generalist requirements. One-third of those elk-security acres occur in wilderness whereas 2/3 occur in non-wilderness designations. We defined security areas for forest-interior species based on the pine marten, which, on the neighboring Medicine Bow National Forest, uses large tracts of lodgepole and spruce/fir cover types with moderate to dense canopy coverage (O'Doherty, pers. comm. 2/19/2003). Their needs are broad enough to encompass the needs of most other forest-interior specialists. Using the smallest recorded home-range size of male martens (1,100 acres) studied on the border of the Medicine Bow and Routt National Forests (O'Doherty et al. 1997), forest-interior security areas were defined as blocks of marten habitat at least 1,100 acres in size and more than 100 meters from any road. There are 57 forest-interior security areas, totaling 284,715 acres, on the Routt National Forest that satisfy these forest-interior requirements (a map of forest security areas is available in the project file).

Opportunities to reduce population isolation, habitat fragmentation, and mortality from vehicles include the following:

- Where population isolation and vehicle-wildlife collisions are identified as concerns, construct wildlife underpasses and install fences that funnel wildlife into the underpasses.
- Where new road construction is necessary, locate the road to avoid fragmenting wildlife security areas (see Wildlife Security maps in the attached map packet).

Issues addressed: 6, 7, 8

TW2 and TW3: How does the road system facilitate human activities that affect habitat? How does the road system affect legal and illegal human activities? What are the effects on wildlife species?

In general, the road system provides access for a multitude of human activities, both legal and illegal, that affect wildlife habitat and species on the Routt National Forest. Permitted firewood collection, permitted pole collection, on- and off-road use by motorized vehicles (including snowmobiles), hiking, camping, mountain biking, horseback riding, skiing, accidental fire ignition, wildfire suppression, logging, hunting, and poaching are all facilitated by the road system and all affect wildlife habitat and/or species.

Firewood and pole collection

People collect firewood for localized camping and for heating their residences and cut poles for building fences. Most of these activities occur within 300 feet of an existing road. Firewood collection results in a reduced number of snags (Hann et al. 1997) and down logs (Quigley et al. 1996); pole collection results in a reduced number of small, live trees along roads. Snags and down logs provide essential habitat for many species on the Routt National Forest. Snags offer nest sites for cavity nesting birds, as well as insulated resting sites for American martens. In addition to shelter, snags provide forage in the form of insects for

species such as the hairy woodpecker and northern three-toed woodpecker. Down logs provide travel corridors and cover for small mammals, including the red-backed vole. These corridors are especially critical in the winter when the down logs create insulated tunnels and access points in the snow. Tunnels allow small mammals to forage and remain active year around. Access points allow martens to find prey species under the snow.

Motorized vehicles including snowmobiles

The use of 4-wheel drive vehicles has become more prevalent, and such vehicles often are driven over terrain containing noxious weeds. The branches, stems, and seeds noxious weeds frequently lodge in the under-carriage or bumpers of these vehicles and travel great distances, dispersing seeds along the way. In this manner, motorized vehicles can introduce new exotics to the Routt National Forest. In addition, vehicles regularly transfer seeds from localized patches of weeds on the Routt National Forest to other areas on the Forest, thereby increasing the rate of spread. Four-wheel drive vehicles are not the only noxious weed vectors. Any vehicle driven on Forest lands has the potential to spread noxious weeds. Question EF2 addresses the consequences of noxious weed invasion on wildlife habitat.

Just as roads are vectors for the spread of noxious weeds, roads also are a vector for the movement of snowmobiles across the landscape. The presence of roads equates to an artificially imposed devegetated path that allows snowmobiles to travel in areas they otherwise could not access. If the roads were not there, the forest vegetation, shrubs, trees, and structurally complex down wood would block access to snowmobile travel into many areas. Therefore, roads indirectly affect wildlife habitat by providing a human-created vector by which snow compaction activities are spread. For animals that do not migrate out of snow country, snow itself provides essential insulating habitat during the winter months. The tracks of compacted snow created by these machines can adversely affect wildlife in two different ways: by creating travel routes for competing carnivores and by impacting the environment under the snow. The tracks of compacted snow created by these machines can adversely affect wildlife in two different ways: by creating travel routes for competing carnivores and by impacting the environment under the snow.

Compacted snow routes facilitate the movement of competing carnivores (i.e. coyotes, bobcats, foxes) into lynx habitat (Buskirk et al. 2000). In the absence of roads and trails, snow depths and snow conditions normally limit the mobility of lynx competitors. The consequences of increased predatory competitors on the lynx and its prey are described in Question TW1 of this document.

Snow compaction also can be detrimental to those species dependent on the insulating capacity of snow. For instance, amphibians and many small mammals hibernate below the frozen topsoil during the winter. The depth of frozen topsoil is correlated with the depth of snow. All things being equal, when snow is compacted, the soil underneath will freeze deeper than if the snow were not compacted. This can directly impact hibernating wildlife. Furthermore, some small mammals, such as montane and meadow voles, remain active all winter long by using the insulated environment in the space between snow and soil, known as the subnivian space (Jarvienen and Schmid 1971, Halfpenny and Ozanne 1989, Pruitt 1960). Snow compaction can either eliminate the subnivian space or reduce the temperature within this space, thereby increasing the energy expenditure required by the meadow vole to thermoregulate. Compaction also increases the density of snow which increases the energy costs of small mammals burrowing through the dense snow (Neumann and Merriam 1972). Snow compaction can cause the formation of ice layers in the snow pack that confine animals to areas with too little food to sustain them (Halfpenny and Ozanne 1989). Furthermore, compaction can change the timing of snowmelt. Compacted snow melts more slowly and maintains a partial gas seal over the substrate during spring melt; such a seal can cause high levels of CO_2 in the subnivian space – thus harming or killing the inhabitants. Snowmelt can result in the flooding of subnivian tunnels. Compacted snow holds less liquid water than natural snow, which can reduce the ability of snow to slow runoff and to moderate the effects of thawing (Neumann and Merriam 1972). Flooding eventually forces small mammals out into the extreme temperatures of the ambient air and exposes them to predators.

On the Routt National Forest, snowmobile use is concentrated in several locations (a map of the snowmobile use locations is available in the project file). The following table lists riparian acres of affected by snow compaction. An estimated 17,056 acres of montane vole, meadow vole, and amphibian habitat are at risk of compaction.

Table 15. Watersheds with subnivian wildlife populations at high risk from the effects of snow compaction facilitated by the road system.

Watershed Name	Acres of Riparian Compacted	Total Acres of Riparian	Proportion of Riparian Compacted
Elkhead Creek	1,901	5,887	0.32
Fish Creek	1,838	4,747	0.39
Grizzly Creek Headwaters	534	2,367	0.23
Harrison Creek	228	2,043	0.11
King Solomon Creek	859	6543	0.13
Little Snake River-Whiskey	1,688	8,106	0.21
Lower Bear River C	404	2,941	0.14
Lower Willow Creek	319	3,066	0.10
Michigan River Headwaters	23	136	0.17
Muddy/Milk Creeks	902	3,915	0.23
Soda Creek	896	3,337	0.27
Upper Egeria Creek	181	719	0.25
Upper Rock Creek	1,459	7,036	0.21
Upper Slater Creek	776	4,026	0.19
Walton Creek	2,793	8,082	0.35

The use of motorized vehicles, including snowmobiles, can reduce wildlife habitat effectiveness via noise disturbance, stress and displacement of animals (Cassirer et al. 1992, Ferguson and Keith 1982, Freddy et al. 1986), nest abandonment (Knight and Cole 1991) and interruption of breeding behavior (Boyle and Samson 1985). Constant disturbance can result in changes in behavior, abandonment of territory (Anderson et al. 1990, Knight and Cole 1991) and even death of animals (Leptich and Zager 1991). Snowmobile traffic can disturb wildlife during critical winter periods. Winter tends to stress animals more than any other season because food is scarce and energy expenditures for staying warm and traveling through snow are high. These effects are described in TW1, *Reduced Habitat Effectiveness*, of this document.

The following are opportunities for reducing motorized vehicle effects to wildlife:

- Consider certain roads for seasonal closures to reduce the effects of motorized vehicles, including snowmobiles, in some areas of wildlife concern.
- Use temporary closures during each breeding season to protect species of concern such as the sandhill crane.
- Designate certain areas for snowmobile use.
- In other areas, offer snowmobiling only on designated routes to protect large tracts of habitat from motorized disturbances in the winter.
- Implement weed control measures (USDA Forest Service 1995).

Hiking, camping, mountain biking, horseback riding, and skiing

Roads provide access for hikers, bikers, horseback riders, and skiers. Hiking, camping, mountain biking, and horseback riding all have the potential to trample vegetation that serves as wildlife habitat for a suite of species and to act as vectors for noxious weed dispersal (Question EF2). Roads facilitate the encroachment of all of these activities into areas that would otherwise be difficult for humans to access. Therefore, the presence of roads increases the risk of vegetation trampling and noxious weed dispersal. Closed roads increase hiking and mountain biking activities in areas not usually accessed by humans.

All these activities, both on and off trail, result in higher levels of disturbance to wildlife species and Proposed Endangered, Threatened, and Sensitive (PETS) plant species than in unroaded areas. The presence of humans moving through the environment is perceived as a threat by some wildlife. Such wildlife may experience similar disturbance patterns as described above in Question TW3, *Motorized vehicles including snowmobiles* and TW1, *Reduced Habitat Effectiveness*. This disturbance can range from temporary displacement of individuals to abandonment of territories. Cassirer et al. (1992) demonstrated that cross-country skiers are likely disturb elk when closer than 1,700 meters from them. Gutzwiller et al. (1994, 1997) and Riffell et al. (1996) determined that off-trail hikers displaced birds from otherwise suitable habitat. In fact, off-trail hiking may cause more stress to animals than on-trail hiking (as summarized in Knight 2000). Furthermore, food scraps are often associated with these activities and can attract certain species to the area. The food reward can lead to the habituation of certain species to the presence of humans and can create nuisance wildlife.

Skiing results in snow compaction which can have similar, but perhaps less extensive, effects as described above under *Motorized vehicles including snowmobiles*. The impacts of skiing likely do not extend to as large an area as snowmobiling for the simple reason that snow mobiles travel faster and therefore cover more ground (and compact more snow) in a given period.

Camping concentrates activity in specific locations and is facilitated by the road system because recreationists can access both developed and dispersed campsites throughout the Routt National Forest. Food scraps are more concentrated at campsites than along trails and make nuisance wildlife more prevalent at these sites. Nuisance wildlife can range from gray jays or camp jays (*Perisoreus canadensis*) loudly calling around campers and stealing campers' food to black bears (*Ursus americanus*) damaging tents, backpacks, and other equipment in the pursuit of food scraps. Bear-camper interactions are a safety issue for both the campers and the bears. Problem bears may be trapped and relocated in an effort to reduce human-bear interactions. Other times, a threatened human may resort to shooting a bear in a threatening confrontation. Both the relocation and the killing of nuisance wildlife is an adverse effect to wildlife increased by the presence of roads on the Forest.

The following are opportunities to reduce effects of nonmotorized activities to wildlife:

- Instill a "leave no trace" and "bear aware" ethic into our community of recreationists through an active education program.
- Locate bear-proof garbage cans at concentrated campsites.
- Strategically close certain low-value roads to reduce the encroachment of recreationists into wildlife habitat.

Accidental wildfire ignition and wildfire suppression

Roads facilitate access to otherwise remote locations in the Forest. The increased number of people able to access the Forest directly translates to an increased risk of accidental wildfire ignition by humans. A spark from a carburetor, cigarette, match, campfire, stove, or flare could start a fire that would not have occurred without the increased access allowed by roads (1997 Routt Forest Plan). Wildfires can burn less than an acre to hundreds of thousands of acres of vegetation. Any such burn transforms portions of the affected forest community from a live, green cover type to a standing, dead cover type. This results in a change in wildlife species that are able to inhabit the affected area. Interior forest species would be displaced, and snag-dependent species such as woodpeckers would increase.

Though fire is a natural disturbance, the frequency and magnitude of fires likely would be different from the normal disturbance regime experienced by the Forest in the absence of roads and road-related activities. Due to the increased risk of accidental ignition associated with increased access to Forest lands, fire frequency is expected to be higher in roaded areas. Furthermore, roads also allow faster, more effective fire-suppression efforts and can act as firebreaks. Thus, the magnitude of those fires is expected to be smaller than in the absence of roads. On the Routt National Forest, the road system is expected to change the natural fire regime from relatively infrequent, stand-replacing fires (Veblen 2000) to more frequent, small-scale fires (Question EF3).

Forest vegetation management

Management of forests, including clearcut logging, partial cuts, and mechanical fuel treatments, are facilitated by the presence of roads. All of these management tools modify wildlife habitat. These treatments remove some or all of the canopy cover, reduce structural complexity, alter the understory shrub layer, and reduce the amount of interior forest available. Wildlife species depend on each of these components as sources of food and shelter. The changes associated with timber harvest tend to be different than changes associated with natural disturbances like fire, insects, and wind. The chief distinction is the removal of wood that provides structural complexity used by wildlife for cover while resting, breeding, nesting, and traveling. Wood also provides a niche for insects to thrive, thereby creating a food source for many wildlife species. Occasionally, management of a forest is geared toward improving the habitat for wildlife. In these cases, the road system assists in the habitat improvement efforts.

Noise, commotion, traffic, dust, and increased human presence associated with logging can cause disturbance, stress, and displacement of animals (Cassirer et al. 1992, Ferguson and Keith 1982, Freddy et al. 1986), nest abandonment (Knight and Cole 1991), and interruption of breeding behavior (Boyle and Samson 1985). Constant disturbance can result in changes in behavior, abandonment of territory (Anderson et al. 1990, Knight and Cole 1991), and even death of animals (Leptich and Zager 1991). Disturbance is described further in Question TW1.

The following are opportunities to reduce the impacts of forest vegetation management on wildlife:

- Restrict vegetation management activities to less critical times of year for surrounding species of concern. For instance, logging can be halted during the breeding season or winter, depending on the species in question.
- Identify key areas for their unroaded characteristics.

Hunting and poaching

Both open and closed roads facilitate access for legal hunting, as well as poaching. Effects to wildlife include direct human-caused mortality and injury from hunting activities. Closed but not decommissioned or obliterated roads increase human access, including illegal use of closed roads by ATVs. This is a problem on many of the closed roads on the Routt National Forest during hunting season. . This increased activity can result in disturbance to wildlife species. Poaching effects are similar to hunting effects.

On the Routt National Forest, the motorized use of roads during the fall hunting seasons, as well as the increased pressure by hunters, has negatively impacted the movement patterns of big game in this area. Elk and deer respond to this increased pressure by leaving National Forest land and moving to adjacent private land where they remain throughout the hunting season. Most hunters cannot gain access to hunt on private land. Increased human activity associated with high road densities on the Forest and the subsequent seasonal movement of big game off the Forest decreases hunter success. This contributes to the excessively high big game population on the Forest.

For about 13 years, the elk and deer herds on the Forest have been, and continue to be, above the desired population objective set by the Colorado Division of Wildlife (Jim Hicks, pers. comm., 3/26/2003). When big game herds become too large, the surrounding vegetation can suffer. For instance, elk and deer can consume too much of the grasses and willows that serve as habitat for numerous species. In these situations, wild ungulates can over-browse aspen seedlings and girdle aspen trees. The consequences of ungulate over-browsing can be a reduction or loss in aspen regeneration.

The following opportunity can reduce hunting and poaching impacts on wildlife:

- During the hunting season, use seasonal closures in strategic areas to keep more ungulates on federal, rather than private, land.

Issues addressed: 5, 6, 7, 8, 9

TW4: How does the road system directly affect unique communities or special features in the area?

As mentioned in Question EF1, sensitive plant populations, peatlands, old growth forest, and rock outcrops exist on the Routt National Forest. Additionally, Special Interest Areas (SIAs) are unique communities or features that have been identified through a separate process. In certain areas, roads directly affect these unique communities and features.

Wetlands

Roads can affect the hydrology of wetlands, which provide for rare plant habitat and/or serve as paleo-ecological and archeological time-capsules. Seeps, springs and wet meadows, which are relatively abundant across the landscape, could also be negatively affected by the current road system by causing increased erosion and sedimentation and population isolation of wildlife inhabitants (Questions AQ2, AQ4, AQ8, AQ10, AQ14, TW1).

Of the 115 sixth-level watersheds on the Routt National Forest, 88 have level 1-2 roads and 74 have level 3-5 roads intersecting with riparian, wetland, or wet meadow habitat (Table 14). For those watersheds in which roads intersect wetlands/riparian zones, there is an average of 0.63 miles/mile^2 of level 1-2 roads and 0.61

miles/mile^2 of level 3-5 roads within these cover types. Across the entire Forest, there are 2,552 road crossings within wetland/riparian cover types.

Opportunities to reduce effects to wetlands include the following:

- Focus future road maintenance on areas where roads approach or intersect wetland/riparian zones, as well as their upland recharge areas.
- Design road/stream crossings to avoid unwanted population isolation of aquatic and amphibian species.
- Focus maintenance on reducing erosion and sedimentation while maintaining the optimal integrity of the wetland/riparian zones.

Old growth

Old growth forest is characterized by a combination of features including: the presence of very large trees, multiple-aged trees, a multi-storied canopy, snags in various states of decay, and large amounts of coarse woody debris. These features equate to wildlife habitat that non-old growth forest does not provide. Since it generally takes 200-400 years for a stand to achieve old-growth characteristics, such stands cannot be recreated quickly or easily. Roads affect old growth forest by fragmenting it, and rendering it less effective habitat for associated wildlife species (Question TW1). Within the Routt National Forest, there are lodgepole stands transitioning to spruce-fir that are exhibiting old growth characteristics. There are also spruce-fir stands, which are exhibiting old growth characteristics. Current data is not sufficient to quantify densities of roads within old-growth cover types.

Opportunities to reduce effects to old growth include the following:

- Avoid old growth or old growth recruitment stands when constructing future Level 3-5 roads.
- Focus obliteration and rehabilitation efforts on roads in old growth or old growth recruitment stands.

Rock outcrops

Rock outcrops often provide broad scenic views, unique plant communities, and uncommon wildlife habitat (e.g. pika, *Ochotona princeps*) that are distributed in isolated patches across the Forest. Most of the 50,229 acres of rock on the Routt National Forest occur in unroaded wilderness areas. Hence, there are only about 7 miles of roads (Level 1-5) on rocks/rock outcrops, or about 0.1 miles/mile^2 across the entire Forest, but throughout non-wilderness, this goes up to 0.4 miles/mile^2.

The following is an opportunity to reduce effects to rock outcrops:

- Select roads that lead to scenic vistas on rock outcrops in primary recreation areas and consider closing or reducing the Objective Maintenance Level on lower value roads on rock outcrops – especially where there are notable species or habitats of concern.

Special management designations

There are two types of special management designations pertinent to wildlife and botanical features that would potentially be affected by roading: Special Interest Areas (SIAs) and Research Natural Areas (RNAs). RNAs are described in EF1. Roads in SIAs may degrade the habitat supporting the unusual botanical or zoological features for which some SIAs were designated. Such habitat degradation could involve sedimentation in riparian areas, the spread of noxious weeds that compete with desirable botanical features, or any of the numerous road effects on wildlife described in Questions TW1-3. Currently, there are 7 SIAs, totaling 28,700 acres, and 3 RNAs, totaling 31,400 acres, on the Routt National Forest.

Table 16. Density of roads in SIAs selected for their zoological values on the Routt National Forest, except for those areas that overlap with wilderness, and are therefore roadless by definition.

Name	Square Miles	Miles of Road	Miles/Mile^2
Black Mountain SIA	1.19	0.95	0.80
California Park SIA	35.89	16.44	0.46
Camp Creek SIA	1.89	0.00	0.00
Encampment River SIA	0.98	2.72	2.78
Little Snake SIA	2.78	2.38	0.86
Total	42.73	22.49	4.9

Issues addressed: 6, 7, 8

Ecosystem Functions and Processes (EF)

EF1: What ecological attributes, particularly those unique to the region, would be affected by roading of currently unroaded areas?

Proposed, Endangered, Threatened, and Sensitive plant populations

Roading in currently unroaded areas could extirpate individual plants or whole populations of Proposed, Endangered, Threatened, and Sensitive (PETS) plants. Ground disturbance and vehicular traffic provide vectors for the invasion of noxious weeds that could displace PETS plants. Tree felling, ground disturbance, and soil compaction to build roads causes habitat modification including disruptions of the microclimate and/or hydrologic conditions required by some PETS plant species. Herbicide and mechanical treatments of noxious weeds in the road corridor could negatively affect PETS plants. The following table lists PETS plants with habitat on the Routt National Forest.

Table 17. Proposed, endangered, threatened, and sensitive plants with habitat on the Routt National Forest.

Scientific name	Common Name	Status on the Routt National Forest
Botrychium lineare	Slender moonwort	Candidate Threatened. Suspected but not documented on the Forest. Found on grassy slopes among medium-height grasses, along the edges of streamside forests between 7,900 to 9,500 feet elevation.
Carex livida	Livid sedge	Found in near Big Creek Lake in peatlands-fens, floating mats, bogs, and marls dominated by *Carex* spp.
Cypripedium fasciculatum	Clustered lady's slipper	Distributed across the Forest as small isolated populations in forested stands of lodgepole pine and spruce/fir.
Drosera rotundifolia	Roundleaf sundew	R2 Sensitive. Occurs in floating peatlands and bogs at the edges of acidic ponds, fens, or lakes. Found in the Big Creek Lakes area.

Scientific name	Common Name	Status on the Routt National Forest
Festuca hallii	Hall fescue	R2 Sensitive. Found in montane meadows, on slopes, and at the edges of open coniferous woods and meadows at 6,800 to 11,000 feet. It is usually found on soils derived from calcareous parent material but is also reported on volcanic soils. It occurs in edges between open meadows and *Pinus contorta – Picea engelmannii* forests or in tundra.
Ipomopsis aggregata spp weberi	Rabbit ears gilia	R2 Sensitive. Populations typically occur in montane zones within open meadows and sagebrush cover types. The core of this local endemic is located on Rabbit Ears Pass.
Machaeranthera coloradoensis	Colorado tansy aster	Typically found in open gravelly sagebrush and dry tundra on specific soil microsites including limey-sandstone, shaley-gypsum, and redbed slopes. Found in Big Creek Park near the Forest.
Pestemon harringtonii	Harrington's beardtongue	Found on calcareous soils in big sagebrush or pinyon-juniper forest. Found near Yampa but not documented on the Forest.
Sullivantia hapemannii	Hapeman's coolwort	Associated with calcareous cliffs and boulder fields.

Peatlands

Peatland habitats are among the rarest wetland types at the temperate latitudes. Peatlands began developing approximately 10,000 years ago (Cowardin et al. 1979). They provide habitat for a variety of R2 sensitive and locally rare plant species, and they also serve as paleo-ecological and archaeological time capsules. They are often defined by the accumulation of peat (i.e., un-decomposed organic matter generally over 30 cm depth). Peatlands are the only ecosystems with organic soils (histols). In the absence of disturbance, they are uniquely stable and self-perpetuating. Integrity of peatland ecosystems is inherently tied to hydrologic conditions (USDA 1998). Resiliency, or the ability to recover from disturbance, is low in peatlands. Roading could alter the hydrology of this unique feature by intercepting surface and subsurface flows, and/or changing the concentration of nutrient inputs in the incoming water. There is no known method for creating or restoring peatlands (USDI 1998) so it is not possible to mitigate losses resulting from road building. Therefore, roads could have significant detrimental effects to these unique features

Seeps, springs, and wet meadows

Compared to peatlands, seeps, springs, and wet meadows are relatively abundant across the landscape, but cover a small area compared to the diversity of plants and wildlife they support. These wet areas provide habitat for a variety of PETS plants and wildlife. Building roads in unroaded areas that contain seeps, springs or wet meadows could alter the hydrology of these habitats by redirecting or decreasing water levels and/or changing the concentration of nutrient inputs. Although these areas are more resilient and more receptive to restoration than peatlands, restoration can take years to decades and cannot always precisely replace what was lost. Hence, unroaded areas containing these features should remain unroaded to avoid the loss of a high-value resource.

Willow bottoms

Building roads in unroaded willow bottoms would degrade these areas by increasing vehicle traffic and off-trail recreation through these sites that can negatively affect wildlife and many PETS species. Many roads already exist along willow bottoms on the Routt National Forest, so this habitat is already impacted. Willow bottoms are not necessarily unique, but there is relatively little of it on the Forest and it provides high value wildlife forage, cover, and breeding areas.

Old growth

Old-growth forest provides highly valuable and difficult to replace wildlife habitat, as described in TW4. Roads affect old growth forest by fragmenting it and rendering it less effective habitat for associated wildlife species (Question TW1 and TW4). Building roads in large tracts of unroaded old growth would degrade one of the most important traits of such areas – the continuous unfragmented forest interior required by many habitat specialists, including PETS species. Tree felling to build roads in small patches of unroaded old growth could reasonably be expected to reduce or eliminate key habitat features (dens, rest sites) that allow certain species to occupy the area. Such a reduction/elimination likely would equate to the loss of a territory for certain PETS species. Tree felling and soil compaction to build roads in riparian strips of unroaded old growth would reduce or eliminate the habitat effectiveness (TW1) and corridors such strips provide for many PETS species.

Rock outcrops

Rock outcrops often provide broad scenic views, unique plant communities, and wildlife habitat (e.g. pika, *Ochotona princeps*) that are distributed in isolated patches across the Forest. On the Routt National Forest, rocky sites in non-Wilderness contain a high density of roads (0.4 miles/mile^2, see TW4). Building roads in unroaded rock outcrops would reduce the remoteness of these habitats, introduce disturbance to unique plant and animal communities, degrade the habitat offered by these outcrops, and perhaps alter the rock features themselves.

Special management designations

Two types of special management designations would potentially be affected by roading: Special Interest Areas (SIAs) and Research Natural Areas (RNAs). SIAs were designated based on the presence of unusual characteristics (i.e. botanical, geological, historical, paleontological, scenic, and/or zoological) in those areas. Building roads in unroaded portions of SIAs could degrade or remove the habitat supporting the unusual botanical or zoological features for which some SIAs were designated. The 1997 Routt Forest Plan addressed each of these special management designations and provides direction and guidelines to protect the unique features.

EF2: To what degree do the presence, type, and location of roads increase the introduction and spread of exotic plant and animal species, insects, diseases, and parasites? What are the potential effects of such introductions to plant and animal species and ecosystem function in the area?

Exotic plants

Roads provide a primary corridor for the transport and spread of noxious weeds. Roads may influence the spread of exotic plants through direct transport via vehicles or indirectly by altering habitat and creating early seral, bare soil or patchy ground cover that favors weedy species. Canada thistle, *Cirsium arvense*, has a scattered patchy distribution across most of the Routt National Forest. Roads that dissect more moist areas are particularly likely to spread Canada thistle. Other noxious weeds documented on the Routt National Forest include leafy spurge, Russian knapweed, ox-eye daisy, chamomile, whitetop, dalmatian toadflax, yellow toadflax, hounds toungue and musk thistle. Noxious weeds could displace PETS plants through competition for light, nutrient and water resources.

Disease and parasites

Roads do not increase the spread of diseases or parasites within the Routt National Forest.

Animals and insects

Roads can increase the abundance of edge-associated species, which then can prey upon or replace forest-interior species (see Question TW1 for more detail).

EF3 and EF4: How does the road system affect ecological disturbance regimes in the area? To what degree does the presence, type, and location of roads contribute to the control of insects, diseases, and parasites?

Roads do not directly affect ecological disturbance regimes, with the possible exception of human-caused fire. Rather, the presence of roads and their location impacts management options and effectiveness in dealing with the effects of disturbance processes. In general, roads provide access for efficient sampling, monitoring, and ground-based treatment of forest insects, diseases, and parasites. Likewise, roads provide access that increase the effectiveness of fire suppression efforts.

The most common disturbance agents affecting the Routt National Forest ecosystems are insects, disease, drought, wind, and fire. Although these agents can act independently, they often occur in a cyclical pattern, with the presence of one setting the stage for the occurrence of another. As an example, an extended drought may set the stage for an insect epidemic resulting in tree mortality, subsequently adding to the fuel loading and creating conditions where a stand replacement fire could occur.

The majority of stands within National Forests in Colorado, including the Routt National Forest, are increasing in age and becoming more susceptible to damaging agents such as insects, disease, windthrow, wildfire, etc. Damage and mortality due to such disturbances are escalating. As the stands continue to mature, an increase in both the incidence and severity of these types of disturbance events is anticipated (Forest Plan, Annual Monitoring and Evaluation Report, Fiscal Year 2001).

Recent events have borne out the expectation that there will be an increase in both the incidence and severity of these types of disturbance events. In October 1997, an intense windstorm occurred along the west boundary of the Mount Zirkel Wilderness, north of Steamboat Springs, Colorado. This event, known as the Routt Divide Blowdown, caused extensive windthrow to Engelmann spruce, subalpine fir and lodgepole pine trees on approximately 7,600 acres within the Mount Zirkel Wilderness and an additional 5,300 acres outside the wilderness. This event created optimal conditions for a major spruce beetle epidemic in southern Wyoming and western Colorado.

Due to stand conditions and events such as the Routt Divide Blowdown, insects and disease will continue to play significant roles in the successional and disturbance processes at work on the Forest. Sixty percent of the Forest is considered mature forest. These areas are conducive to outbreaks of the more damaging insect and disease agents (Forest Plan, Appendix D, p. D-30). Recent aerial surveys indicate an increase in insect and disease activity consistent with the aging conditions of the forest. Insect and disease agents on the Routt National Forest include dwarf mistletoe, mountain pine beetle, and spruce beetles.

A forestwide survey conducted on the Routt National Forest indicated 52% of the lodgepole pine type was infested with dwarf mistletoe. Seventy-two percent of the lodgepole pine stands on the Forest are at moderate or high risk for infestation by mountain pine beetle, and there are large epidemics presently occurring on the Forest in Grand and Jackson Counties, in the east Troublesome, Green Ridge, and Owl Mountain areas (Forest Plan, Annual Monitoring and Evaluation Report, Fiscal Year 2001, p. 12). Aerial surveys conducted in August 2002 detected a continued increase in spruce beetle caused mortality within the Bark Beetle EIS analysis area. Observable mortality increased to 210,000 trees and 50,000 acres in 2002, approximately 18 times the number of infested trees and 12 times the infested acreage from 2001. In 2002, the Burn Ridge (approximately 14,120 acres), Hinman (approximately 16,839 acres), and other fires on the Forest killed many spruce beetles and destroyed thousands of acres of potential spruce beetle habitat. However, these fires

have had little impact on the current spruce beetle epidemic across the Bark Beetle EIS analysis area and have not altered the course of the epidemic (USDA Forest Service 2003).

The most damaging pathogen to lodgepole pine is dwarf mistletoe. The road system has helped the Forest Service use silvicultural practices to control dwarf mistletoe. Forest roads are generally ineffective in acting as a barrier to the spread of this parasite because of the narrowness of the opening and because dwarf mistletoe is transported by birds and other wildlife. The road system is not aiding in the spread of this parasite.

Fire is the disturbance process most affected by roads and access. The Routt National Forest is generally in a low-frequency/high-intensity fire regime. Consequently, fuel loads tend to accumulate, resulting in potentially large, high-intensity fires. For the period from 1970 to 1995, the Forest has averaged about 8 lightning- and 10 human-caused fires per year over 1.3 million acres. These fires have burned, on average, 134 acres per year. The average fire size over that same 25-year period was 7.45 acres. The largest fire was 1,104 acres (Forest Plan, FEIS, Appendix D, p. D-36). However, in 2002 fires burned over 37,000 acres on the Forest. This was due largely to drought conditions, but can also be attributed to high fuel loads from different disturbance processes including the Routt Divide Blowdown, the 1940 spruce beetle epidemic in the Flattop Mountain range, and increased timber mortality from both spruce and mountain pine beetle activity.

Naturally occurring fire hazard can be related to age, stand structure, and stand density. Fire hazards are greatest in older stands where an accumulation of ground fuels has occurred. On the Routt, 60% of the forested lands are mature, 35% are pole sized, and 3% are seedling-sapling. Therefore, more than half of the forested lands are in or approaching a high fire hazard condition (Forest Plan, FEIS, Chapter 3, p.3-89). Road access may result in some increase in the number of human-caused fires but is also conducive to rapid initial attack and suppression. Likewise, road access facilitates initial attack of natural-caused fires where such suppression is desirable. Roads may also act as a firebreak for low to moderate intensity fires but would likely have little effect in halting a high intensity fire.

In general, the road system, and specifically the maintenance level 3 - 5 roads, provides adequate access to those Forest areas where it is desirable to respond to disturbance events that may occur. One exception to this general statement is some of the suitable timberlands located both within and outside Inventoried Roadless Areas, as noted in the response to TM 2-3. Another exception includes the 1.32 Management Areas of the Troublesome and Middle Yampa Geographic Areas. Guidelines in the Forest Plan allow for entry into 1.32 MAs for the purpose of timber salvage or silvicultural treatment to control insect epidemics; however, the road system is inadequate for this purpose. Certain residential/forest interface areas, such as the one identified in the Morrison Creek Geographic Area, also lack adequate access.

Issue addressed: 3.

Related question: PT1

EF5: What are the adverse effects of noise caused by developing, using, and maintaining roads?

Goshawks, elk, martens, and lynx respond to various degrees of road use and construction/maintenance noise. Nesting goshawks exhibit alarm behavior when noise and activity from road use, construction, or maintenance occurs near their nest. Generally, a ¼-mile buffer around goshawk nests is accepted as sufficient distance for noise and activity to occur. Noise from road development and use could move big game when and where they are not desired (including private land where they may damage agricultural products and become inaccessible to most hunters). Refer to Question TW1: Indirect Effects - *Reduced Habitat Effectiveness* and Question TW3 for more information on the adverse effects of noise on wildlife. See UR/RR3 for a discussion of the effects of noise on recreation.

Economics (EC)

EC (1): How does the road system affect the agency's direct costs and revenues? What, if any, changes in the road system will increase net revenue to the agency by reducing cost, increasing revenue, or both?

At the forest scale, this question can be answered in broad terms. A detailed cost/benefit economic assessment is not feasible. The IDT for the Routt National Forest RAP addressed this question by developing the Road Value versus Risk matrix and using this tool to determine what roads fell into which Road Management Category.

The R2 Guidance for this question determined that there are three basic categories of roads: 1) roads that will always be open for obvious reasons, 2) roads that will be closed due to serious resource damage or annual budgetary constraints, and 3) roads that don't fall into either of the first two categories (the largest category).

When looking at all road maintenance levels, the R2 Guidance is appropriate. However, the Routt RAP only considered level 3, 4, and 5 roads. The IDT determined early in the process that an assumption that most of these roads would always be kept open for obvious reasons was appropriate. Most of these roads were developed over the years for a variety of access needs, and considerable capital investments were incurred to construct these roads. Most of these roads were analyzed in some form; for example, use needs, construction design standards, environmental considerations, and economic assessment.

The challenge is to develop a process to sort out level 3, 4, and 5 roads that might not be meeting current and future access and land management needs, at least not at their current maintenance levels. This process helps identify opportunities to reduce road maintenance costs on some roads. The IDT also determined that even if funding was shifted from low value roads to higher value roads, the annual road maintenance funding for this forest was still significantly less than needed.

EC (2): How does the road system affect the priced and non-priced consequences included in economic efficiency analysis used to assess net benefits to society?

EC (3): How does the road system affect the distribution of benefits and costs among affected people?

These are subforest-scale questions, not forest scale questions.

Commodity Production (TM, MM, RM, SP, SU, WP)

Timber Management

TM1: How does the road spacing and location affect logging system feasibility?

This question is most applicable at the subforest scale during project analysis. It is an important consideration, however, for determining timber suitability, management area allocations, and economic efficiency during a forest plan revision.

Most sales on the Routt National Forest are logged with ground-based equipment. The trees are either felled by hand with chainsaws or cut mechanically with a feller buncher and then yarded to the landing with rubber tired grapple skidders. Machine felling is much more common than hand-felling because it is safer, more productive, and less labor intensive. In general, a road spacing of 2,000-3,000 feet would be economical for ground-based skidding.

The cut-to-length logging system has been tried in Region 2. This system uses a mechanical processor that cuts, limbs, and bucks the logs to length, at the stump. The logs are then brought to the landing on a forwarder. It is possible to yard logs longer distances with a forwarder and thus the road spacing can be a little wider. However, due to high purchase price and relatively low cut volumes per acre, the cut-to-length system has not proven to be more economical than conventional rubber tired systems in this Region. If cut-

to-length systems are required in timber sales to increase road spacing, stumpage values will be reduced and there will be a greater chance of no-bid timber sales.

In general, close road spacing results in quick turn times and higher production that reduces yarding cost and increases stumpage value. Although closer road spacing can increase the total road cost due to more roads, this total cost can be reduced with the use of temporary roads.

Traditionally, cable logging systems are not common in Region 2. The location of a road is particularly important for cable logging. Roads are generally located above the unit and along the "slope break" to provide better deflection which is needed to reduce damage to resources and equipment. In the past, cable logging equipment and skills were not available in Colorado. However, new cable logging technology—tracked "yoaders" (excavators, feller-bunchers, or loaders retrofitted with winches, cables, and masts) and tong-throwers—may soon be available. A road spacing of 2,500 to 4,000 feet would accommodate small- and medium-sized yarders, including "yoaders."

Helicopter logging has been used in the Region on a limited base. It is an extremely expensive system. The only way a helicopter system can be used economically on the Forest, with our usual stumpage values, is to have several other low-cost, ground-based units included in the timber sale to offset the cost. Helicopter logging feasibility is improved by locating roads and landing to provide downhill yarding and short yarding distances (less than ½ mile).

Many different logging systems were used on the Routt Divide Blowdown. Excavators were used to sever root wads and process logs for grapple skidders. Timbco feller-bunchers and high-clearance logging shovels with grapple heads were used to pre-bunch logs for both ground-based skidding, skyline yarding, and helicopter yarding. Road spacing in the Blowdown ranged from 1,500 to 4,000 ft.

In general, the road spacing is adequate for logging systems used on the Routt National Forest; however, there may be site-specific projects where road construction (temporary and specified) is necessary. Generally, road construction is only allowed where it is economically and technically necessary to achieve resource management objectives. The most efficient road spacing that would maximize timber stumpage values is generally not acceptable because it usually conflicts with other resource management objectives.

TM 2-3: How does the road system affect managing the suitable timber base and other lands? How does the road system affect access to timber stands needing silvicultural treatment?

Roads provide the primary access to the forest for planning, designing, and implementing a wide range of vegetation management activities to manage the suitable timber base and other lands. Most silvicultural treatments on the Forest are accomplished through conventional ground-based methods requiring an adequate road system.

During the forest plan revision process, specific consideration was given to areas with developed road systems when tentatively suitable lands were allocated to management area prescriptions that contribute to the ASQ. Past timber management has provided the basic network of roads to access the suitable timber base. As a result, the majority of the suitable land base has an established arterial and collector road system in place to facilitate necessary vegetation management.

The Forest Plan identified 754,600 acres out of the 1,356,700 total Routt National Forest acres (approximately 65%) as tentatively suitable (Appendix B, Table B-1, p. B-6). When the Forest Plan was signed, 357,821 acres (approximately 26%) were identified as land suitable for timber management (FEIS, Appendix B, Table B-2, p. B-6). Of the 357,821 acres identified in the Forest Plan as land suitable for timber management, 59,287 acres, or approximately 17%, were comprised of conifer stands within roadless areas (FEIS, Chapter 3, Table 3-94, p. 3-256).

After the Forest Plan was signed, management of the Williams Fork area was transferred to the Arapaho-Roosevelt National Forests. Suitable acres (29,021) in the Williams Fork area were subtracted from the

suitable acres identified in the Forest Plan. The resulting total was 328,800 acres of suitable land. The number of suitable acres in roadless areas also decreased slightly.

As displayed in the FEIS, road construction and reconstruction at the desired condition level was projected at 16.2 and 9.8 miles/year, respectively. At the experienced budget level, these projections drop to 9.3 miles of construction and 5.2 miles of reconstruction, per year, for the 1st decade. A large part of this planned road construction and reconstruction was to provide access to suitable timberland. The majority of the planned construction and reconstruction would consist of local roads.

As displayed in Chapter 2 of this roads analysis, actual road construction averaged 3.3 miles/year for the first five-year period of the plan, and actual road reconstruction averaged 6.1miles/year. Projected road construction and reconstruction at the desired condition level has not been met for the first five-year period of the Forest Plan. This is largely due to a decrease in timber sales.

Although this Forest roads analysis specifically concentrates on maintenance level 3, 4 and 5 roads, access may be provided by maintenance level 1 and 2 roads as well. The extent to which the road system accesses the suitable timber base was examined by comparing the spatial proximity of the current road system (objective maintenance level 1 – 5 roads) with the suitable timberlands. Ninety-three percent of the suitable acres are within 1 mile of a classified road. In general, this would indicate that the existing system, specifically the existing arterial and collector network, provides adequate access to the suitable timber base. There are suitable timberlands outside IRAs that lack adequate access. Two good examples are the 5.11 MA within the Morrison Creek GA and west of the residential/forest interface and the 5.11 MA within the Chimney Rock and Troublesome GAs in the Rabbit Ears drainage and Matheson Reservoir areas.

Of the suitable timber base acres located more than 1 mile from a maintenance level 1 - 5 road, about half are located within Inventoried Roadless Areas (IRAs). Of the suitable acres within IRAs, 78% are located within 1 mile of a maintenance level 1 – 5 road. Some of this suitable timberland could be accessed through temporary road construction or by constructing or reconstructing local roads. Access to other suitable acres within IRAs would require the construction of collector systems. Some areas are roadless due to physical constraints (steep slopes, unstable soils), critical wildlife habitat, and/or lack of right-of-way (e.g., Troublesome Geographic Area). However, where road construction is possible, there are likely to be conflicts over any road construction in IRAs.

The final Roadless Area Conservation Rule was published in the Federal Register on January 12, 2001. The final rule prohibits road construction, reconstruction, and timber harvest in IRAs. A subsequent Administrative Order suspended implementation of the Roadless Conservation Rule. On May 4, 2001, the Secretary of Agriculture announced a reexamination of the Roadless Area Conservation Rule, with a public comment period that closed on September 10, 2001. The Forest Service issued two Interim Directives on July 27, 2001, reserving to the Chief of the Forest Service, with some exceptions, authority to approve timber harvest and road construction and reconstruction in roadless areas. Depending on the outcome of the Roadless Conservation Rule, a forest plan amendment may be necessary to change management area prescriptions and revise geographic area direction.

Issue addressed: 3

Minerals Management

MM1: How does the road system affect access to locatable, leasable, and salable minerals?

The Forest Service administers its minerals program to achieve the following:

- Encourage and facilitate orderly exploration, development, and production of mineral resources from National Forest System lands.
- Ensure that exploration, development, and production of mineral resources are conducted in an environmentally sound manner and that these activities are integrated with planning and the management of other National Forest recourses (FSM 2802).

Mineral resources are separated into three categories: locatable, leasable, and saleable.

Locatable Minerals are those deposits subject to location and development under the General Mining Law of 1872 (as amended). The Forest Service does not manage the mineral resources on National Forest System lands. That authority rests with the Secretary of the Interior. Forest Service authority is directed at the use of the surface of National Forest System lands in connection to the operations authorized under the United States mining laws (30 U.S.C 21-54), which confer a statutory right to enter upon the public lands to search for minerals. Forest Service regulations at 36 C.F.R. 228, Subpart A provide that operations shall minimize adverse environmental impacts to the surface resources, which includes the following:

- Using all practicable measures to maintain and protect wildlife habitat affected by an operation.
- Reclaiming surface disturbances, where practicable.
- Rehabilitating wildlife habitat.

Additionally, the regulations also address roads needed for mineral activities. Roads are to be constructed and maintained to minimize or eliminate damage to resource values (including wildlife). Unless otherwise authorized, roads no longer needed for operations will be closed to normal traffic, bridges and culverts removed, and the road surface shaped to approximate the natural contour and stabilized.

Under the general mining laws, the Routt National Forest is available for locatable mineral exploration and development. However, the Bureau of Land Management has withdrawn some areas within the Forest boundary from mineral entry; mineral entry or activity in these areas is not allowed. These areas include, but are not limited to, Congressionally designated wilderness areas, Research Natural Areas, National Recreation Areas, Administrative Sites, Special Interest Areas, etc.

Throughout the Forest, those with mineral rights have access allowing them to work their claims, and these routes may be closed to the general public. Arterial and collector roads are used to access individual claims, and access is addressed on an individual basis. The vast majority of roads constructed into mining claims are/will be temporary. Where reconstruction/construction and reclamation are necessary for access, bonding is required as part of Operating Plans or Notice of Intent.

Leasable Minerals are federally owned fossil fuels (oil, gas, coal, oil shale, etc), geothermal resources, sulfur, phosphates, and uranium. These minerals are subject to exploration and development under leases, permits, or licenses issued by the Secretary of the Interior, with Forest Service consent. The 1920 Mineral Leasing Act (as amended) and the 1989 Federal Onshore Oil and Gas Leasing Reform Act provide the authority and management direction for federal leasable minerals on National Forest System lands.

Some areas on the Forest are withdrawn from mineral leasing, including Wild and Scenic Rivers, National Recreation Areas, National Historic Sites, Research Natural Areas, and other specific classifications. In these areas, the Forest Service recommends leasing activities only when terms and conditions can be applied that will protect the purpose for which the lands were classified.

The Routt National Forest completed an Oil and Gas Leasing EIS and the Record of Decision (ROD) was signed on March 15, 1993. This document dealt with Forest lands having high or moderate potential. Forest lands with low or no potential were addressed in the 1998 forest plan revision. The following table lists the approximate acres authorized for leasing by category.

Table 18. Approximate acres available for leasing on the Routt National Forest (from 1993 ROD).

No Surface Occupancy	215,000 acres
Timing and Controlled Surface Use	15,000 acres
Timing	20,000 acres
Controlled Surface Use	140,000 acres
Standard Lease Terms Only	135,000 acres
Total Authorized For Leasing	525,000 acres

As of February 2003, the Routt National Forest has received requests for lease applications totaling 118,000 acres. Road access for leasable minerals is generally planned and developed on a large grid and on a individual basis. Production of leasable minerals will require some high-standard haul roads. Existing arterial and collector roads are utilized to access the general location and are sufficient for that purpose. Transportation plans are generally developed as part of each leasable activity.

Salable Minerals include mineral materials, otherwise known as "common varieties" which generally include deposits of sand, gravel, clay, rock or stone used for a number of purposes including road surfacing, construction materials, and landscaping. The disposal of these materials is by a materials contract issued at the discretion of the Forest Service. All contracts contain requirements for reclaiming the sites, as much as practicable, to pre-mining conditions.

Existing arterial and collector roads are sufficient to gain access to the general location of salable minerals. The value of salable common variety minerals is very sensitive to transportation costs. Unlike locatable and leasable minerals the Forest Service has complete control over common variety minerals and is under no obligation to authorize their sale.

Range Management

RM1: How does the road system affect access to range allotments?

The network of roads on the Routt National Forest can have positive indirect effects on rangeland condition and positive direct effects on access and administration of the grazing program. Typically, sheep and cattle are now transported to and from mountain allotments in trucks rather than trailed on stock driveways. As a result, the vegetative condition and overall health of these driveways has improved dramatically. Until the 1970s, livestock driveways were considered "sacrifice areas" in the rangeland management discipline (Stoddart and Smith 1955).

The road network on the Routt National Forest improves the administration capability of the range management program. Administratively, the road network now allows range conservationists to access allotments quickly by using vehicles rather than horses, which improves monitoring for permit compliance. Grazing permittees have likely experienced lowered operating costs by having motorized access to allotments.

The current maintenance level 3-5 road system provides adequate access for range management purposes on most of the forest. There would be an opportunity to improve access for range administration in the Troublesome Geographic Area of the Parks Ranger District.

Special Products (SP)

SP1: How does the road system affect access for collecting special forest products?

The road system provides the primary means by which commercial harvesters and individuals access and transport special forest products such as Christmas trees, posts, poles, firewood, transplants, mushrooms, ferns, etc. The majority of harvest and collection is accomplished manually and therefore takes place in close proximity of the road system.

The existing road system provides sufficient access for collecting special forest products.

Special Use Permits (SU)

SU1 - How does the road system affect managing special-use permit sites (concessionaires, communication sites, utility corridors, and so on)?

The existing road system is adequate to serve the needs of existing or anticipated special uses. There are problems due to illegal/unauthorized use of routes (not NFSRs) south from Matheson Reservoir and the route known as 105 that runs up the center of the Troublesome Basin. There are private land inholdings that do not have authorized access in the following areas: Matheson Reservoir, Corral Peak area, and the center of the Troublesome Basin. There is a need for additional access in the Pinkham Mountain area and the Michigan Guard Station area (reciprocal right-of-way).

Overall, the current road system provides good access for recreation special use permits (outfitter/guides and recreation residences). Access for non-recreation special uses (private property, ditches/reservoirs, rock sites, (etc.) is fair. There are some private land access issues as well as ditch/reservoir access issues, but these are most often being addressed on a case-by-case basis. Access to private lands and water facilities does not necessarily need to be on level 3-5 roads. These permits can be part of a closed road system that the holder maintains to desired Forest Service standards. For additional discussion, see Chapter 5, Issues # 4 and 5.

Water Production (WP)

WP1: How does the road system affect access, constructing, maintaining, monitoring, and operating water diversions, impoundments, and distribution canals or pipes.

The existing road system is sufficient to access existing water diversions, impoundments, and distribution canals and pipes. The larger impoundments and diversions tend to be accessed by the arterial and collector roads. However, the Forest does have numerous agricultural ditches and reservoirs that are closed to public access and are accessed by the permittees on a "by request" basis only. This access is for inspection and maintenance only and is required by their permit. Public motorized access on these roads is generally restricted, and extensive use by the permittee is usually addressed with maintenance requirements in their permit.

Maintenance level 3-5 roads with easements to access water diversions and impoundments are identified in the road matrix (Appendix C).

WP2: How does road development and use affect water quality in municipal watersheds?

The 1997 Routt Forest Plan designated most of the Fish Creek (140500010407) and a small portion of the Soda Creek (140500010408) 6th-level watersheds as municipal watersheds. The overall road risk rating (AQ6) for these watersheds was low and moderate respectively, indicating only minor risks of road development and use affecting water quality in these watersheds. There are areas with high surface erosion potential in both watersheds, but these generally do not overlap with the road system. The greatest potential effects of the road system are from the Buffalo Pass road (NFSR 60) where it runs adjacent to the stream system on soils with high surface erosion potential in the Soda Creek watershed.

Related question: AQ7.

WP3: How does the road system affect access to hydroelectric power generation?

The Routt National Forest does not have any hydroelectric power generation facilities.

General Public Transportation (GT)

GT1: How does the road system connect to public roads and provide primary access to communities?

National Forest System roads connect numerous public roads managed and operated by either the state of Colorado or county governments. However, few Forest roads serve as the primary through-routes that connect communities. Of greater importance is how the county roads and state highways give communities, tourists, and industries access to the National Forest. These roads connect to arterial, collector, and some local roads at the Forest boundary where traffic is dispersed into the Forest for a variety of uses. Some county and state highways traverse into or through the National Forest. The following table lists public roads identified as important to linking the National Forest to public roads and local communities.

Table 19. Public roads under county or state jurisdiction that access the National Forest.

Public Road Number/Name	Termini
Jackson County, Colorado	
6W	CO State Highway 125 – Forest boundary, NFS Road 80
12W	Walden – NFSR 640
11	CO State Highway 14 – NFSR 700
21	CO State Highway 125 – NFSR 740
24	CO State Highway 14 (at Hebron) – NFSR 60
28A	County 25 – NFSR 720
53	CO State Highway 14 – NFSR 103
Rio Blanco County, Colorado	
Forest Highway 16	Phippsburg – White River NF boundary (to Meeker)
121	Moffat County 67 – NFSR 990
990 / Williams River	County line – Forest boundary
Moffat County, Colorado	
1	WY border – Routt County 82
11	CO State Highway 13 – NFSR 112
27	CO State Highway 13 – NFSR 110
38	CO State Highway 13 – NFSR 109
67	Routt County 29 – Rio Blanco County 121
Routt County, Colorado	
3	CO State Highway 131 – NFSR 910
7	Yampa – NFSR 900
15	CO State Highway 131 – NFSR 930
16	CO State Highway 14 – NFSR 270

Public Road Number/Name	Termini
Routt County. Colorado, cont.	
17	CO State Highway 131 – County 15
25	Oak Creek – NFSR 925
29	County 27 – Hamilton
36	Steamboat Springs – NFSR 314
55	County 29 – Forest Hwy 16
62	County 129 (at Clark) – NFSR 42
64/(400)	County 129 – NFSR 400
80	US 40 (at Hayden) – NFSR 150
82	Moffat County 1 – NFSR 150
129 / Little Snake River	US 40 (at Steamboat Springs) – WY Border
320	Oak Street – Fish Creek PG
321	US 40 – Ski Area
Grand County, Colorado	
11	County 1 – NFSR 212
21	US 40 – NFSR 112
Colorado State Highways	
13	Craig, CO – Baggs, WY
14	Ft. Collins, CO – US 40 (Muddy Pass)
125	US 40 – WY State Line
127	CO St. Hwy 125 – WY State Line
131	I-70 (at Wolcott) – US 40 (Steamboat Springs)
134	US 40 - CO State Hwy 131 (Toponas)
Wyoming State Highways	
230	WY State Hwy 130 – WY State Line
Federal Highways	
US 40	I-70 (at Empire, CO) – Craig, CO

The Routt National Forest road system does not provide any primary access routes to or between communities. However, local communities use several Forest roads for recreation and commercial access to the National Forest. As population increases, recreation and commercial use of the road system is also expected to increase.

The following table lists major population centers and public and Forest System roads used for primary access to the National Forest.

Table 20. Primary county, state, and forest roads providing access to and through the National Forest.

Community, Town, or City	Public Roads	National Forest System Roads
Craig, CO	US Hwy 40 CO State Hwy 13 Moffat County 1, 2, 11, 18, 27, 29, 38	109.1, Sand Point 110.1, Black Mountain 112.1, Freeman Reservoir 150.1, California Park
Granby, CO	US Hwy 40 CO State Hwy 125 Grand County 21	106.1 Willow Creek 112.6, Corral Peak
Encampment/Riverside, WY	WY State Hwy 230 CO State Hwy 125, 127	550.1, Whiskey Park 80.1, State Line 895, Camp Creek
Kremmling, CO	US Hwy 40 CO State Hwy 134 Grand County 21	100.1, Red Dirt 103.1, Chimney Rock 112.6, Corral Peak
Steamboat Springs, CO	US Hwy 40 CO State Hwy 131 Routt County 36, 62, 80, 82, 129, 320, 321, 400	150.1, California Park 400.1, Seedhouse 550.1, Whiskey Park 60.1, Buffalo Pass
Walden, CO	CO State Hwy 14, 125, 127 Jackson County 6W, 12W, 11, 21, 24	103.1, Chimney Rock 106.1 Willow Creek 60.1, Buffalo Pass 600.1 Big Creek Lake 640.1, Lone Pine 700.1, S Fk Arapahoe Cr 740.1, Teller Divide 80.1, State Line
Yampa, CO	CO State Hwy 131, 134 Routt County 3, 5, 7, 15, 16, 17, 25, 29, 55, 67, 132 Rio Blanco County 16, 55, 990	270.1, Morrison Cr 285.1, Green Ridge 900.1, Bear River 925.1, Trout Cr 930.1, Crosho Lake 990.1, Williams River

These roads and others are important to smaller communities around the Forest. Many people in these communities rely on access to the Forest for their livelihood as well as for recreation. The Forest is important for mining, timber, ranching, and tourism. Some of those communities are listed in the following table. Some subdivisions (Bighorn Park, Old Park, and Gallager Ranch) near the Forest have larger populations than some small towns.

Table 21. Small residential communities near the Routt National Forest.

Jackson County, CO:	Cowdrey, Gould, Kings Canyon, Pearl, Rand
Routt County, CO:	Clark, Columbine, Hahns Peak, Hayden, Phippsburg, Oak Creek
Carbon County, WY:	Baggs, Savory

GT2: How does the road system connect large blocks of land in other ownership to public roads?

National Forest System roads do not provide primary access to most large blocks of land in other ownership. Public lands surrounding the National Forest include the Colorado State Forest, other Colorado state lands, Bureau of Land Management and State Wildlife Area lands. The Arapaho-Roosevelt and White River National Forests are adjacent to the Routt National Forest and share access roads. The following Forest roads access these lands.

Table 22. Forest roads providing access to lands under other ownership.

Ownership other than Routt NF	Forest Roads
Colorado State Forest	NFSR 204, 740, 780, 881, 882
Bureau of Land Management	NFSR 609, 720, 771
Radium State Wildlife Area	NFSR 212, 214
Indian Run State Wildlife Area	NFSR 970
Stagecoach State Park	NFSR 270
Other Colorado State lands	NFSR 103, 239
Arapaho National Forest	NFSR 112, 204, 881
White River National Forest	Forest Highway 16

The amount and dispersion of private and other ownership lands varies across the Forest. Maintenance level 3-5 roads access most private inholdings. However, some inholdings are accessed by lower standard local roads and some by no roads at all, such as in roadless areas. Access needs for inholdings are addressed on an individual basis as requests are received. Forest Service policy is that access will be provided to a level that is reasonable and suitable for the uses occurring on the land. When landowners desire access, they are asked to apply for a special use or road use permit. The application is then analyzed through the NEPA process to determine possible environmental effects and the level of reasonable access required.

Some private land inholdings use National Forest System (NFS) roads for access. When these tracts are subdivided, the resulting multiple ownership can increase demands on the road system. Converting roads to other jurisdictions (e.g., county or road district) should be considered when use has increased beyond the needs of general Forest access. This eliminates the need for the Forest Service to enter into road use or special permits with each individual landowner. When the county grants permission for a subdivision that will be accessed by a NFS road, the county or state should be encouraged to assume jurisdiction on that portion of the road.

Access is normally limited to summer or non-snow periods, but on occasion; permits are issued for snowplowing during the winter. There is an increase in year-round occupancy of some private inholdings on the Forest. The impacts on the road system with increased winter use are discussed in SI1 and WU1.

In some areas, the Forest Service lacks adequate legal access to the public road system. Priorities for acquiring access are identified during planning for commercial or land management projects.

Historic access across some private land is being closed to the public as ownership and land uses change. While this is not a change in legal status, it gives the appearance of shutting off large tracts of public land. Where access is needed for forest management, additional rights-of-way may need to be pursued.

An important aspect of National Forest System roads is that they are not public roads. Although they generally are open and available for public use, they are authorized only for the administration, protection, and utilization of National Forest System lands. The Forest Service is a public roads agency with the authority to designate certain National Forest System roads as public roads. By definition, a Public Forest Service Road

(PFSR) is under Forest Service jurisdiction with a valid right-of-way and a maintenance level 3-5. These roads are designated "open to public travel" in accordance with the following (23USCs101(a)):

- The roads must serve a compelling public need.
- The roads would remain open and meet Federal Highway Safety Act requirements. Exceptions would be for scheduled seasonal closures or emergency closure needs.

To date, and per agreement with the Federal Highway Administration, most maintenance level 3-5 roads have been subject to the Highway Safety Act requirements but without the public road designation.

The Forest Service has identified certain routes as potential PFSRs. In addition, necessary construction work to improve these roads to the appropriate standard has been identified. Potential PFSRs are identified in the road matrix (see the Appendix C – Road Matrix). Further analysis through travel management and NEPA may be required for these roads.

Opportunities where the Forest road system accesses other ownership lands include the following:

- When road use patterns change, review the road for appropriate jurisdiction and maintenance responsibility.
- Pursue new rights-of-way where forest access is not adequate for management needs.
- Encourage counties to assume jurisdiction on portions of roads that access subdivisions.

Issues addressed: 3, 4, 5

Related questions: GT3, SI1, WU1, SU1

GT3: How does the road system affect managing roads with shared ownership or with limited jurisdiction? (RS2477, cost share, prescriptive rights, FLPMA easements, FRTA easements, DOT easements)

The definition of jurisdiction has been subject to different interpretations over the years. "Jurisdiction is the legal right to control or regulate use of a transportation facility derived from fee title, an easement, an agreement, or other similar method. While jurisdiction requires authority, it does not necessarily reflect ownership." (FSM 7705). A review of the INFRA database shows a need to verify that the correct jurisdiction is reflected. A thorough research of jurisdiction and legal rights-of-way is recommended for all roads, especially roads with current projects proposed. The Travel Routes Data Dictionary provides examples of the correct coding for roads with a variety of circumstances. Updating the Forest right-of-way atlas is also recommended.

Rights of access by law, reciprocal rights, or easements are recorded in Forest files and county courthouse documents. The Forest recognizes these rights and works with the owners to preserve access while protecting the natural resources and facilities on adjacent National Forest System lands. There is also an understanding by the Forest Service that individuals or entities may have established valid rights, unknown to the Forest Service at this time, to occupy and use National Forest System lands and roads. The courts have established that such valid outstanding rights may be subject to some federal regulation (*Sierra Club v. Hodel,* 848 F 2d. 1068, 10th Circuit, 1988). This analysis recognizes that such valid outstanding rights may exist, and the Forest Service will honor such rights when it is subsequently determined that the specific facts surrounding any claim to such rights meet the criteria for occupancy and use.

Non-federal ownership of lands or interests in lands may include rights granted as part of a reserved or outstanding right or as provided in statute or treaty. Roaded access is the most common type of access pursued in conjunction with two of the more prominent statutes:

- The Alaska National Interest Lands Conservation Act (ANILCA)[3]
- Recognized highway rights-of-way granted over NFS lands under Revised Statute 2477 (RS 2477)[4].

ANILCA ensures access to non-federal land inholdings: "*The authorized officer shall authorize such access deemed adequate to secure the landowner the reasonable use and enjoyment of their land."* This access may not be the most direct, economical, or convenient route for the landowner and may not be road access in all cases. Alternative routes and modes of access may be considered. If a landowner has an adequate alternative route or mode of access, including access across other land ownerships, the Forest Service is not obligated to authorized roaded access. Reasonable access is currently determined on a case-by-case basis. The Forest Service recognizes valid ANILCA access as a statutory right. Additional discussion on access to private inholdings is included in question GT2.

Requests for access to private inholdings during the winter months have been increasing in recent years. Historically, winter road use has been restricted by snow. This new winter use of the road system creates concerns including adequate road design, strength of the surfacing material to support traffic in other than dry or frozen conditions, safety with mixed-use traffic, wildlife concerns with increased winter traffic, and recreation concerns with the change in winter use patterns. This issue is discussed more thoroughly in questions RR2 and WU1.

RS 2477 grants rights-of-way for public highways constructed across public domain lands in the late 1800s to early 1900s. A RS 2477 highway must have been constructed across public domain lands before the date of the national reservation; for example, before the land became a National Forest or Grassland. The Routt was designated a National Forest in 1905. The Federal Lands Policy Management Act (FLPMA) repealed RS 2477 in 1976. However, rights-of-way that predate the establishment of the national forest are still in effect, unless they have been subsequently relinquished. There is currently a moratorium on processing RS 2477 claims. Any reviews are undertaken on a case-by-case basis.

Numerous roads crossing the Forest fall under the jurisdiction of other agencies. When desirable, cooperative agreements should be established to share road improvement and maintenance responsibilities when all partners can benefit.

Forest Highways are designated under the Federal Lands Highways program of the Transportation Equity Act for the 21st Century (TEA21). These routes are state, county, or Forest Service owned roads qualifying for Highway Trust funding for improvement or enhancement. They provide access to and within the National Forest.

[3] Public Law 487. Alaska National Interest Lands Conservation Act of 1980. Act of December 2, 1980. 16 U.S.C. 3210.
[4] Public Law 94-579. Revised Statute 2477 (RS 2477). Rights of Way and Other Easements on Public Land. October 21, 1976. 43 U.S.C. 933

Table 23. Forest Highways on the Routt National Forest.

Forest Highway Route No./Name	Description	County	Length (miles)
16.1 Marvine-Phippsburg (Dunckley Pass)	This route starts the junction with State Highway 131 south of Phippsburg, CO and proceeds west over Routt County Roads 15 and 132 to the county line, then into Rio Blanco County on NFSR 16 to the White River National Forest boundary (where it continues as NFSR 8 towards Meeker, CO).	Routt and Rio Blanco	34.2
129.1 Hahns Peak Highway	This route starts at the junction with US Highway 40 west of Steamboat Springs, CO and proceeds north to the Wyoming border.	Routt	51.6

Portions of these forest highways may still be under the jurisdiction of the Forest. When funding is secured and improvements are made to bring these sections to Federal Highway Administration standards, they will be turned over to either the state or county. The Forest needs to cooperate with these agencies by supporting them in their efforts to obtain funding through the Federal Lands Highway Program.

The Forest has cooperative maintenance agreements with the following counties: Grand, Jackson, Routt, and Rio Blanco. These agreements define the joint road maintenance plans for identified roads. The degree of shared maintenance can vary depending on the most efficient operations for parties involved (see FSM 1509.11-23 and R2 Supplement 1509.11-96-1 for a more complete explanation of the agreements).

The Forest works cooperatively with the Colorado Department of Transportation on highways that pass through the Forest. There are resource concerns with the application of magnesium chloride and the type of snow plowing in the winter months, especially on US 40 over Rabbit Ears Pass. Efforts can be made to voice the resource concerns and work out possible mitigation measures. One of C-DOT's primary concerns will always be public safety.

There are no cost-share agreements with private or public landowners on the Forest. The diversity of ownership and lack of any sizeable inholdings does not indicate a need to pursue agreements of this type.

Opportunities to address jurisdiction and maintenance concerns include:

- A thorough review of jurisdiction and legal rights-of-way is recommended for all roads, and especially roads with current projects proposed.
- Bring lands and engineering specialists into the project early to help determine if access is going to be an issue.
- Update the Forest right-of-way atlas, and keep it current.
- Keep existing road maintenance agreements (Schedule A) updated.
- Pursue agreements with other counties and land management agencies.

Issues addressed: 1, 5, 11

Related questions: GT2, UR/RR2, WU1, AU2

GT4: How does the road system address the safety of road users?

In 1975, the Forest Service developed a Memorandum of Understanding (MOU) with the Federal Highway Administration that required the Forest Service to apply the requirements of the National Highway Safety Program to all roads open to public travel. In 1982, this agreement was modified to define "open to public

travel" as "those roads passable by four-wheeled standard passenger cars and open to general public use without restrictive gates, prohibitive signs …" Most roads maintained at level 3, 4, and 5 meet this definition. Design, maintenance, and traffic control on these roads emphasizes user safety and economic efficiency.

The largest proportion of road maintenance and improvement funds allocated to the Forest is spent on these higher standard roads that are subject to the Highway Safety Act. Safety work (e.g., surface maintenance, roadside clearing, installation and maintenance of warning and regulatory signs) are performed on an annual basis. During the winter, these roads are not usually plowed open. Some are subject to seasonal restrictions to prevent road damage during the early spring when the roads are drying out. Traffic control signing follows standards set forth in the Manual on Uniform Traffic Control Devices (MUTCD). Exceptions are permitted where state or county practices on similar public roads deviate from these guidelines. Signing should conform with local practice in those situations where use of MUTCD guidelines would be confusing to the motorist.

When accidents occur on Forest roads, often the Forest Service is not immediately informed unless an employee is involved. Accidents involving only public motorists are reported to the local sheriff or state patrol, if reported at all. When the Forest does become aware of an accident, an investigation is initiated to attempt to identify the cause. If a feature of the road is found to be unsafe, addressing the condition becomes a high priority.

Road condition surveys conducted in 1999 to 2002 revealed a backlog of over $1.8 MM in deferred health and safety work items on level 3-5 roads in the analysis area. A large portion of this backlog is a result of deteriorated road surfacing on aggregate-surfaced roads. In the past, road-resurfacing projects were planned as part of commercial timber sale activities. The decline of this program has reduced the Forest's ability to fund this work.

Many arterial and collector roads do not meet standards for alignment or roadbed width. Built originally for commercial use, design considerations did not emphasize the high volumes of public recreational traffic experienced today. Many roads lack sight distance, turnouts, and adequate lane width needed for the higher volume and speed of traffic now occurring. Another high-cost item is removal of roadside brush. Level 3, 4, and 5 roads need to be placed on a recurring schedule to maintain sight distance and a safe clear zone. While this work has been part of the annual maintenance program, it is often dropped in years when budget allocations are reduced. Finally, warning and regulatory signing contributes significantly to the backlog. Engineering studies are currently being conducted to determine the actual warning sign needs on the higher standard roads. As funding levels permit, these signs are being installed. Sign maintenance after installation is part of the annual maintenance program of work.

Maintenance level 1 and 2 roads that intersect the higher standard roads need to be clearly distinguished from those managed for passenger car use. This can be accomplished in a variety of ways. The surface type and condition of the lower standard road should convey the impression that a high-clearance vehicle is needed. The route marker used to identify the road should be placed back from the intersection so it does not readily attract attention to the road. It should also be shaped so the number is vertically aligned and not of the distinctive or rectangular shaped signs used on level 3, 4, and 5 roads. The closure device on roads that are maintained at level 1 should be visible from the intersection or have a clear warning sign for traffic approaching the closure. During watershed and project-scale analysis, Forest officials should give high priority to recommending decommissioning those roads that pose the greatest risk to public safety.

There is a potential for hazardous safety conditions when there is mixed-use traffic on public roads. Road Management Objectives (RMOs) are developed for each road in accordance with FSM 7712.5. Road management objectives establish design criteria (FSM 7720) and operation and maintenance criteria (FSM 7730.3) for each road. RMOs require approval and signature by the District Ranger and Forest Engineer, and become part of the road atlas (FSM 7711.1). Safety concerns and travel management restrictions should be addressed in the RMOs, especially where mixed traffic is a concern. Appropriate signing and education can help alleviate the safety concerns. RMOs should be updated to reflect changes in management or resource

needs. Documenting the primary use of the road and any safety issues can also help prioritize funding to address critical health and safety concerns.

Travel management regulations are posted on the ground and described on the Forest Visitor's map. These regulations have been established by the Forest to enable safe motorized travel while protecting natural resources and minimizing conflicts between users. Off-road recreational vehicles such as trail motorcycles and ATVs are discouraged on higher standard arterial and collector roads but not prohibited. Colorado state law governs registration of off-road vehicles. This law also applies to out-of-state visitors. These licensed vehicles can then be operated on public roads, including designated Forest Service roads and trails. An effort for consistent signing statewide will show which uses are allowed on each road and trail. Over the next few years, these signs will be installed on all Forest roads and trails. Some counties have separate restrictions for off-road vehicle travel on county roads. Users should be educated when allowed uses change as different jurisdictions are crossed.

Law enforcement responsibility for road related regulations are sometimes unclear. Signing and law enforcement responsibility on roads can be further defined by agency in joint use maintenance agreements (Schedule A). Efforts to keep signing and closure orders up to date and educating the public about permitted road uses can help consistency in law enforcement efforts.

Opportunities for safety-related road issues:

- Prioritize funding to address critical health and safety needs.
- Ensure road design is adequate to meet the expected traffic on the road to meet the management needs as described in the RMOs. Keep RMOs up to date.
- As set forth in MUTCD, establish and maintain proper signing on roads subject to the Highway Safety Act (most maintenance level 3, 4, and 5 roads).
- Inform users of type of travel permitted on Forest roads through appropriate signing and education, especially when the road crosses through different agencies' jurisdictions.
- Develop an accident reporting system to track locations, types, and frequencies of motor vehicle accidents on Forest roads.

Issues addressed: 2, 10, 12

Related question: AU2

Administrative Use (AU)

AU1: How does the road system affect access needed for research, inventory, and monitoring?

The road system provides access for a variety of research, inventory, and monitoring activities. Some of these activities are internal to the Forest Service, and some access is provided for other entities conducting the activities. Examples of some of these uses include National Atmospheric Deposition Program sites for air quality monitoring, Remote Automated Weather Stations for fire weather recording, Snowtel sites, USGS stream gages, and NRCS sites for snow depth measurements. The current road system appears adequate to serve these needs.

Two special area designations on the Forest emphasize research, inventory, and monitoring: Research Natural Areas (RNAs) and Special Interest Areas (SIAs). There are three designated RNAs and seven SIAs on the Forest.

Table 24. Research Natural Areas and Special Interest Areas on the Routt National Forest.

Research Natural Areas	Special Interest Areas
Kettle Lakes	Black Mountain
Mad Creek	California Park
Silver Creek	Camp Creek
	Encampment River
	Teller City
	Little Snake
	Windy Ridge

Standards and guidelines in the 1997 Routt Forest Plan preclude road and trail construction in RNAs, except where construction of new roads and trails is necessary to correct resource damage from existing trails. Most of the three RNAs are inside designated Wilderness Areas and are not susceptible to changes in existing road management (see Forest Plan FEIS Appendix F and question SI3). However, winter motorized use poses a threat to these areas, where they are easily accessed from off snowmobile trails or road corridors. The road system providing access to the designated RNAs is adequate.

In Special Interest Areas, new roads can be constructed only when consistent with SIA values, such as interpretation or education, or to meet other resource objectives. Additional access is discouraged in order to preserve the qualities of the area (see Forest Plan FEIS at page 3-190). There are adequate roads to bring scientists, interested observers, and monitoring personnel into the SIAs.

Related questions: SI3, TW4, EF1

AU2: How does the road system affect investigative or enforcement activities?

The level 3, 4, and 5 road system on the Routt National Forest generally provides good access for investigative and enforcement activities. These roads provide access to developed and dispersed recreation sites where many common violations occur. These roads also provide access to the many developed trailhead-parking areas for the trail system that provides backcountry access. While the road system provides access to perform investigative and enforcement activities, it also provides access for increasing public use of the National Forest System lands, hence, the Forest is experiencing an increase of criminal activities.

The FY2002 Rocky Mountain Region Law Enforcement (LE) Plan lists 5 major criminal problem areas: 1) travel management, 2) unauthorized uses, 3) theft of forest products, 4) minors in possession of alcohol and illegal drugs, and 5) residential occupancy. While this LE plan identifies several causes for each of these major criminal problem areas, they are all facilitated by the existence of a good road system. However, there are no known direct road-related causes of significant illegal activities.

Off-road motorized travel, primarily ATV use, is the most common travel management violation, and the level 3, 4, and 5 road system provides the access for these vehicles. The demand for OHV opportunities on the Forest is increasing, suggesting a need for more designated motorized trails. People driving around road closure devices on level 1 and decommissioned roads is another travel management violation. The Forest needs to address user-created routes and unclassified roads in project level decisions.

Ineffective road closures can facilitate the illegal motorized use of the closed portion of the transportation system. This problem mostly occurs on maintenance level 1 roads, decommissioned roads, temporary roads, and roads that are closed seasonally. Planning for the appropriate type and location of the road closure will

help alleviate this problem. Identification of the closed road system, both on the ground and with maps, and closure orders are essential for law enforcement personnel to ensure compliance with the closures.

Some of this illegal use comes from access off private lands where no public access is available. Forestwide standard for Infrastructure – Travelways states "Prohibit motorized access from private land where access for the general public is not available, except by special use permit." While this is not an issue for the Forest level 3,4,5 road system, it is an enforcement concern related to illegal travel on Forest roads.

Ineffective closures can also lead to trespass from the National Forest System lands on to adjacent private and public lands. Making the closure devices more effective would help with this problem. Enforcement of the closures can be a problem since the trespass occurs off Forest land.

Most of the unauthorized uses are in the form of illegal outfitting and guiding. Many of these violations are directly related to the level 3, 4, and 5 road system when non-permitted commercial driving tour operators attempt to derive a profit from this road system. These roads also provide access to the backcountry trailheads where non-permitted commercial snowmobiling and hunting activities occur.

Theft of forest products is also usually directly related to the level 3, 4, and 5 road system. These violations mostly involve thefts of firewood, transplants, and Christmas trees. Some commercial level thefts of these products occur most years, and these thefts are usually dependant on the level 3, 4, and 5 roads system. Sawtimber theft is also dependant upon this road system since it requires large log-hauling vehicles.

There are increasing incidences of minors in possession of alcohol and illegal drugs on the Forest. Much of this activity is in the form of evening partying, which often occurs near the urban areas just off level 3, 4, and 5 roads. These gatherings often result in other resource and property vandalism.

Opportunities:

- Inform users of type of travel permitted on Forest roads through appropriate signing and education, especially when the road crosses through different agencies' jurisdictions.
- Keep Road Management Objectives (RMOs) and travel orders up to date.
- Use road closure devices and methods that are most appropriate to the terrain and intermittent access needs.
- Plan for effective closures during initial design phases of the road.
- Use closure methods that provide for hydrologic stability and eliminate vehicle travel. Methods can include ripping and seeding, constructing berms and water diversion structures, removing culverts, pulling slash and stumps across the road bed, scattering boulders, putting the road back to the original contours, planting trees and shrubs in the roadbed, gates and signs. The most effective closure methods will be identified on the ground and documented in the RMO.

Issues addressed: 7, 8, 10, 12.

Related questions: GT4, TW3

Protection (PT)

PT1: How does the road system affect fuels management?

Fire is thought to be the most significant natural disturbance agent in high elevation forests of the Rocky Mountains. It has shaped the vegetation mosaic for thousands of years by causing stand-replacing disturbances on a variety of scales. The three major forested cover types of the Routt National Forest, spruce-fir (approximately 33% of the Forest), lodgepole pine (approx. 28%), and aspen (approx. 19%), are significantly influenced by fire.

The Routt is generally in a low-frequency/high-intensity fire regime. Consequently, fuel loads tend to build resulting in potentially large, high intensity fires. Naturally occurring fire hazard can be related to age, stand structure, and stand density. Fire hazards are greatest in older stands where an accumulation of ground fuels has occurred. On the Routt, 61% of the forested lands are mature, 35% are pole sized, and 3% are seedling sapling. Therefore, more than half of the forested lands are in, or approaching, a high fire hazard condition (Forest Plan, FEIS, Chapter 3, p.3-89).

Higher road density and unrestricted motorized travel can increase the risk of ignitions while at the same time aiding fire control efforts. Motorized roads provide access, increasing the level of human activity and the risk of human-caused ignitions. Access provided by these roads can also improve fire crew response time and increase the effectiveness of control efforts. Conversely, limited access in many areas may hamper control efforts by increasing report and response times and allowing fires to grow in size and intensity before the fire crew arrives. Roads may also act as a firebreak for low to moderate intensity fires but would likely have little effect in halting a high intensity fire.

Recent fire events and the advent of the National Fire Plan have resulted in an increased emphasis to reduce hazardous fuels, especially in the wildland/urban interface. The major focus of the Craig-Routt Fire Management Program (CRFMP) is hazardous fuels reduction in the urban interface/intermix and near communities at risk. The ability to implement mechanical fuels treatments or prescribed burns is significantly enhanced by the presence of an adequate road system. An adequate road system provides access to treatment areas for personnel and equipment. In the case of prescribed burning, this is not as critical, but roads do help in reducing the cost of treatment by reducing travel costs to and from the treatment location. Roads make good control lines when implementing prescribed burns, and they provide access for engines and other control equipment, which improves the ability to control prescribed fires. Maintenance level 1 and 2 roads can provide adequate access for these activities.

Accessibility of an area is important factor in mechanical treatment feasibility. Without adequate access, many mechanical treatments are not an option; this further limits fuels management alternatives.

In general, the road system, and specifically the maintenance level 3 - 5 roads, provides adequate access to those Forest areas where it is desirable to implement fuels treatments. The forest has recently initiated several major fuel reduction projects, with more projects identified in the CRFMP. As mentioned above, the focus of much of this fuel reduction planning is the wildland/urban interface. Generally, these urban interface/intermix areas, consisting of summer cabins and year-round homes, have an adequate access for fuels management projects, including commercial harvest to meet fuel reduction objectives. Exceptions to this general statement include certain residential/forest interface areas, such as the one identified in the Morrison Creek Geographic Area.

Issue addressed: 3.

PT2: How does the road system affect the capacity of the Forest Service and cooperators to suppress wildfires?

R2 Guidance identifies this question as being more appropriately responded to at the subforest scale.

PT3: How does the road system affect risk to firefighters and to public safety?

R2 Guidance identifies this question as being more appropriately responded to at the subforest scale.

PT4: How does the road system contribute to airborne dust emission resulting in reduced visibility and human health concerns?

Air quality impacts from the Forest road system are associated with vehicle emissions and dust from traffic on unpaved roads. These effects typically are localized and temporary, and their extent depends on the amount of traffic. Dust from unpaved roads increases with dryness as well as vehicle weight. Forest roads are usually unpaved and are used for recreational purposes (such as passenger car and four-wheel-drive use), as well as resource management purposes related to timber harvest, mining, and oil and gas development.

Motorized recreation occurs year-round. Summer use includes off-highway, two-wheel and four-wheel drive vehicles. When these vehicles travel on unpaved surfaces, they can stir up dust. Air quality data previously collected indicates some visibility impairment in the Mount Zirkel Wilderness Class 1 airshed, a sub-airshed of the Medicine Bow airshed. The visibility impairment is believed to be largely due to upwind sources off the forest and not associated with the Forest road system. However, as use of Forest roads increases with visitation, road dust impacts to sensitive areas may need to be addressed.

Vehicular travel on unpaved roads can be expected to be heavy during resource management activities such as timber harvest, mining, and oil and gas development. These uses typically require dust abatement measures to reduce the air quality impacts of sustained and heavy traffic use. The Forest has applied dust abatement products to higher public use Forest roads that pass through or near residential areas as part of its annual maintenance plan when funds are available. Other mitigation measures may also be necessary, such as reducing haul speeds, watering, and limiting the number of trips per day and the time of day for operations. On unsurfaced roads, temporary increases in dust emissions occur during and after routine surface maintenance when conditions are dry. Watering during blading or scheduling maintenance when natural moisture content is higher would help reduce dust emissions.

Specifying the type of dust abatement product or method and frequency of use is not a programmatic issue. This is a relatively expensive activity and is dependent on budget levels and priorities. Dust abatement should be considered as a mitigation measure for higher traffic volumes resulting from commercial activities and special use permits, particularly on arterial and major collector roads and when traffic is expected near developed recreation sites. It should also be considered on higher volume roads that are in riparian areas where dust could have unacceptable impacts to sensitive plants and animals.

Recreation (UR and RR)

UR1 & RR1: What are the supply and demand relationships for motorized and or nonmotorized recreation opportunities?

Roads are necessary for recreationists. They use them to drive, walk, or bicycle onto and through the forest, yet there is a dichotomy in the way Forest users view roads. Comments received during the 1997 Routt Forest Plan revision and during the public comment period for Routt Divide Blowdown projects illustrate the difference of opinion about the motorized and nonmotorized opportunities on the Forest. Areas are closed or restricted to motorized use in order to achieve other multiple use objectives, such as protecting soil resources

or providing wildlife seclusion during critical birthing and nesting seasons. Closing areas to motorized use sometimes affects traditional access patterns for recreation, hunting, and firewood gathering.

Motorized trail riders say there aren't enough trail opportunities on the Forest. One of the problems for motorized users is their space requirement; according to the American Motorcycle Association, a motorized trail needs to be at least 50 miles in length. Motorized recreationists commented on their need for additional opportunities that could come out of the blowdown projects.

Some people feel unroaded areas need to remain unroaded and not for recreation, but for wildlife and other resource protection from humans. Proposals to build roads after the blowdown elicited negative responses. There were a number of comments expressing concern that preventive thinning and associated road construction would have detrimental impacts on roadless character.

Areas are closed or restricted to motorized use in order to achieve other multiple use objectives, such as protecting soil resources or providing wildlife seclusion during critical birthing and nesting seasons. Closing areas to motorized use sometimes affects traditional access patterns for recreation, hunting, and firewood gathering.

Recreation Opportunity Spectrum (ROS)

The ROS is used to describe the recreation opportunities available and potential on the landscape. The spectrum describes and defines recreation settings that provide different experiences. The presence of roads and the distance from roads are two criteria for determining an area's ROS class. The mix of ROS classes on the Routt National Forest (see the table below) emphasizes the primitive and semi-primitive settings. These settings are on the less developed end of the spectrum.

Table 25. ROS class mix on the Routt National Forest.

ROS Class	Acres	Percent of Total
Primitive	264,751	21.3%
Semi-Primitive Nonmotorized	358,081	28.9%
Semi-Primitive Motorized	412,143	33.2%
Roaded Modified	177,393	14.3%
Rural	13,603	1.1%
Urban	441	0.0%
Roaded Natural	13,608	1.1%

The Rural (R) setting class includes farmland, small communities, commercial facilities, or large campgrounds and trailheads along paved highways in the forest. This setting delineates the area around Highway 40 (Rabbit Ears Pass).

The Roaded Natural (RN) class describes an area with level 3 and 4 roads (arterials) that provide easy access to other, less developed areas. Sightseeing is dependent on maintenance of arterial and collector roads (level 3 and 4 roads). RN areas have subtle modifications to the natural environment. Improvements are limited to roads, trails, campgrounds, and a few scattered structures. There is limited opportunity to get away from others. Timber harvest activities are visible.

The Roaded Modified (RM) class describes larger clearcut areas with skid trails, timber roads, and landings in clear view. As opposed to the RN class, roads are typically temporary (although some level 3 roads are developed), and there is a better chance to get away from other users in these areas less chance to get away from logging activities.

The Semi-Primitive Motorized (SPM) ROS setting offers access on level 1 and 2 roads and no facilities in a backcountry setting (usually >2,500 acres).

The Semi-Primitive Nonmotorized (SPNM) ROS setting offers solitude and quiet in a large (>2,500 acres) area more than a mile from open roads. Some existing SPNM areas were inventoried as roadless in the 1998 forest plan revision. These areas may or may not have been allocated to a management area that retains the roadless character.

Recreation Use

The Forest participated in the National Visitor Use Monitoring project (NVUM) in 2001. Beginning in October of 2000, staff surveyed users at different sites, including along forest roads. Data on use also helps determine user characteristics on the Forest. Nearly all activities require a road for access. Staging areas or trailheads are generally located on a maintenance level 3, 4, or 5 road. The table below illustrates the facilities used by Forest visitors according to the survey.

The table below indicates that, in 2001, half the users to the Forest were downhill skiing (this number is from ticket sales at the Steamboat Springs Ski Area). Viewing scenery is nearly as popular as skiing on this National Forest.

Table 26. Participation in Forest recreation activities.

Activity	Percent Participation	Percent Who Said It Was Their Primary Activity
Downhill skiing or snowboarding	50.6	50.0
Hiking or walking	46.3	13.8
Viewing natural features such as scenery, flowers, etc on national forest system lands	44.9	2.6
Viewing wildlife, birds, fish, etc on national forest system lands	42.8	0.7
General/other – relaxing, hanging out, escaping noise and heat, etc,	31.9	4.0
Picnicking and family day gatherings in developed sites (family or group)	11.4	2.9
Fishing – all types	11.3	7.3
Driving for pleasure on roads	8.4	1.6
Hunting – all types	7.9	7.6
Primitive camping	7.5	1.0
Camping in developed sites (family or group)	7.4	4.3
Off-highway vehicle travel (4-wheelers, dirt bikes, etc)	6.7	0.3
Snowmobile travel	4.1	3.9
Visiting historic and prehistoric sites/area	3.2	0.1
Cross-country skiing, snow shoeing	2.8	2.3
Nature study	2.6	0.1
Other nonmotorized activities (swimming, games and sports)	2.5	0.0

Activity	Percent Participation	Percent Who Said It Was Their Primary Activity
Gathering mushrooms, berries, firewood, or other natural products	2.4	0.2
Bicycling, including mountain bikes	2.1	2.1
Backpacking, camping in unroaded areas	1.2	0.5
Nonmotorized water travel (canoe, raft, etc.)	1.2	0.0
Visiting a nature center, nature trail or visitor information services	1.0	0.1
Horseback riding	0.6	0.2
Resorts, cabins and other accommodations on Forest Service managed lands (private or Forest Service run)	0.2	0.0
Motorized water travel (boats, ski sleds, etc)	0.1	0.0
Other motorized land/air activities (plane, other)	0.1	0.1

Nearly all activities require a road for access. Staging areas or trailheads are generally located on a maintenance level 3, 4, or 5 road. The table below illustrates the facilities used by Forest visitors according to the 2001 survey.

Table 27. Facilities used by survey respondents in FY 2001.

Facility / Area Type	Percent Who Said They Participated (National Forest visits)
Hiking, biking, or horseback trails	65.9
Other forest roads	21.3
Visitor center, museum	17.5
Scenic byway	16.1
Picnic area	13.7
Developed campground	5.7
Designated snowmobile area	5.5
Interpretive site	5.1
Forest Service office or other information site	5.0
Motorized developed trails	4.3
Developed fishing site/ dock	2.6
Swimming area	2.4
Designated Wilderness	2.2
Nordic ski area	2.1
Boat launch	1.1

Trends

It is important to understand trends in recreation use, in order to determine future needs for recreationists. Forty five percent of those surveyed said they had been sightseeing on the Forest, but less than 3% said they came to the Forest just to view scenery. Days spent sightseeing are expected to increase 75% by 2050 (an average 1.5% per year), with the number of trips taken increasing by 90% in that same period (Bowker et al. 1999).

Unroaded recreation is popular among most visitors. Mountain biking has changed dramatically since the late 1980s, and hiking is the most popular trail activity (nationally). Mountain bikers use roads where there are few trail opportunities. They prefer a variety of opportunities, including challenge levels, vistas, and reasonable distances, so it is important to consider the ROS and preferred experiences when identifying roads for trail uses. Mountain biking is expected to increase 60% (an average 1.2% per year) over the next 50 years (Bowker et al. 1999).

Horseback riding and hiking are probably the most compatible trail and road activities. Many areas that are inaccessible by vehicle or bicycle are very accessible by horseback or on foot. Participation rates for both activities are expected to increase over the next 50 years: 60% for horseback riding and 59% for hiking. This is an increase of more than 1% per year, with an equal increase in trips taken and days spent (ibid).

By 2050, days spent off-roading can be expected to increase by 54%, while actual participation will increase 37% (Bowker, English et al. 1999). Age and income levels appear to have an adverse relationship to motorized recreation; use is higher in the younger population with a lower income level. Older users prefer a leisurely OHV trail system (generally an old two-track) where they can see some backcountry without having to walk or ride a horse.

According to the latest census, the population in communities around the Forest is aging (Social Assessment for the Forest Plan, USDA Forest Service 1998). There is an influx of retirees moving into the area from other states, and they have asked for developed access points, identified trails, and better facilities. While some in the older age group prefer easier access to their favorite recreation spots, others want to get to a trailhead and discover the backcountry. In either case, a well-designed road system is imperative for their access.

Issues addressed: 3, 4, 10

Related questions: GT3, GT4

UR2 and RR2: Part 1) Is developing new roads into unroaded areas, decommissioning of existing roads, or changing the maintenance of existing roads causing substantial changes in the quantity, quality, or type of unroaded (or roaded) recreation opportunities? Part 2) How do user-created routes affect the management of the road system?

Few roads were built in unroaded areas over the last decade, so this has not affected current recreation opportunities. Maintenance of existing roads has changed, however, due to a lack of funds and resources. Increasing or decreasing regular maintenance can change the frequency and patterns of use. Roads that provide the opportunity for pleasure driving should be pleasurable to drive on. Decreasing maintenance due to funding shortfalls means the intended comfort level may no longer be experienced on these roads, and over time, they could become uncomfortable for sedan travel. Increasing the road maintenance level changes the use and increases user access and use levels. Recreation is considered in any decision to decommission a road.

Traditionally, roads have been paid for and built to access timber sales or mining activities. In recent years, very few roads have been built due to the decrease in timber sales on the Forest. If the public no longer supports these management activities, funding for road construction will have to come from another source.

Issue addressed: 5, 7, 8, 9, 11

Related questions: TM2, TM3, GT3,

UR3 and RR3: What are the adverse effects of noise and other disturbances caused by developing, using, and maintaining roads on the quantity, quality, and type of unroaded (and roaded) recreation opportunities?

Noise and other disturbances can indirectly affect quantity, quality, and type of unroaded recreation opportunities. Where log-hauling activities are heavy during a season, visitors are displaced into other parts of the Forest. This could affect current users for an unspecified period. Road construction and reconstruction activities can be disruptive to recreation, although temporarily. The Colorado Department of Transportation may be expanding the gravel pit on Dunckley Pass when they resurface the highway. The effect of activities like this depends on current uses in the immediate area, especially dispersed use in adjacent areas. Motorized users (motorcycles, dirt bikes, and OHVs) can affect the solitude of visitors within earshot of roads or motorized trails. These activities need to be managed for their location relative to unroaded opportunities.

In winter, road corridors become snowmobile and ski trails. In some areas, these two activities are not compatible, and the Forest has attempted to separate them. However, in some cases, access is not exclusive to motorized or nonmotorized users, and so until users can disperse away from trailheads or staging areas, noise is not manageable.

Issue addressed: 11

Related questions: TW2, TW3

UR4 and RR4: Who participates in unroaded recreation and road-related recreation in the areas affected by constructing, maintaining, and decommissioning roads?

All Forest users travel the arterial/collector roads (level 3-5 maintenance levels). Level 2 roads provide dispersed recreationists with access into otherwise inaccessible areas. Descriptors of forest visitors were developed based upon those visitors interviewed then expanded to the National Forest visitor population. The table below compares Forest visitors with the general population (from the U.S. Census 2000). Similar to other studies, the survey found that most visitors to the National Forest were male (77%), over 25% more than the general population.

Table 28. Gender distribution of Routt NF recreation visitors and the general population.

Source	Male	Female
NVUM	77%	23%
US Census	50%	50%

In addition to gender, survey findings indicate that most visitors are between the ages 21 and 60. The NVUM study categorized age groups differently than the U.S. Census, but the following table compares those two studies. Nearly 77% of Forest visitors were in these age groups, compared with 59% of the general population. Nearly 10% of the general population is over the age of 65, however survey respondents over age 70 accounted for less than 2%.

Table 29. Age distribution of NVUM survey respondents and the general population.

Age Group	Percent in NVUM Group	Age Group	Percent in 2000 U.S. Census
Under 16	16.8	Under 5 years	6.9
16-20	1.3	5 to 9 years	7.2
		10 to 14 years	7.2
		15 to 19 years	7.1
Total	18.1	Total	28.4
21-30	7.6	20 to 24 years	7.1
31-40	39.2	25 to 34 years	15.4
Total	46.8	Total	22.5
41-50	23.9	35 to 44 years	17.1
		45 to 54 years	14.3
Total	23.9	Total	31.4
51-60	6.8	55 to 59 years	4.5
61-70	3.2	60 to 64 years	3.4
Over 70	1.1	65 to 74 years	5.3
		75 to 84 years	3.3
		85 years and over	1.

The following table illustrates general population trends for the state of Colorado and the counties around the Forest. A high percent of the population in Routt and Grand Counties is between the ages of 18 and 65. Residents of this county also accounted for a high percentage of users surveyed in 2001. Jackson County has a higher population over 65, as compared to the state or other county averages. Site-specific analyses are needed to determine who of these groups use the Forest.

Table 30. Population characteristics of the state of Colorado and counties around the Forest (U.S. Census 2000).

Census Quick Facts	Colorado	Jackson County	Garfield County	Grand County	Moffat County	Routt County
Population, 2001 estimate	4,417,714	1,589	45,521	12,711	13,154	20,255
Population percent change, April 1, 2000-July 1, 2001	2.70%	0.80%	4.00%	2.20%	-0.20%	2.90%
Population, 2000	4,301,261	1,577	43,791	12,442	13,184	19,690
Population, percent change, 1990 to 2000	30.60%	-1.70%	46.10%	56.20%	16.10%	39.80%
Persons under 5 years old, 2000	6.90%	5.60%	7.50%	5.80%	6.80%	5.50%
Persons under 18 years old, 2000	25.60%	25.60%	27.10%	21.80%	28.50	22.60%

Census Quick Facts	Colorado	Jackson County	Garfield County	Grand County	Moffat County	Routt County
Persons 65 years old and over, 2000	9.70%	13.10%	8.80%	7.80%	9.40%	5.00%
Persons between 18 and 65	64.7%	61.3%	64.1%	70.40%	62.1%	72.40%
Female persons, 2000	49.60%	49.70%	48.60%	47.00%	48.10%	46.20%

The NVUM study asked respondents to report their home zip codes. These can be used to determine the communities from which the respondents came. Less than 1% of forest visitors were from another country. The survey did not collect country affiliation. There were about 250 different zip codes reported. The most frequently reported zip codes are shown in the table below; the highest reported residence was Steamboat Springs (24%). Residents from east of the Forest (Colorado Front Range communities) made up 13% of respondents.

The following table also illustrates the problem with the sample of users in this survey. Respondents were self-selected, and none of the respondents reported a zip code from some communities immediately adjacent to the Forest—Yampa, Kremmling, and Walden. Not having a representative sample from these residents poses a problem for planning recreation in the future for them.

Table 31. Residence of NVUM survey respondents by reported zip code.

Zip Code	Frequency	Percent	City/State
80013	5	0.9	Aurora/CO
80014	4	0.7	Aurora/CO
80015	4	0.7	Aurora/CO
80428	5	0.9	Clark/CO
81625	11	2.1	Craig/CO
80210	6	1.1	Denver/CO
80228	6	1.1	Denver/CO
80525	8	1.5	Ft. Collins/CO
80524	7	1.3	Ft. Collins/CO
80526	5	0.9	Ft. Collins/CO
80634	7	1.3	Greeley/CO
80127	7	1.3	Littleton/CO
80120	4	0.7	Littleton/CO
80128	4	0.7	Littleton/CO
80134	4	0.7	Parker/CO
80477	84	15.7	Steamboat Springs/CO
80488	24	4.5	Steamboat Springs/CO
80487	21	3.9	Steamboat Springs/CO
80005	4	0.7	Westminster/CO

UR5 and RR5: What are these participants' attachment to the area, how strong are their feelings, and what alternative opportunities and locations are available?

Local residents and regular users have strong opinions about road and other forms of motorized access. Comments on project proposals indicate that road decommissioning and road building are contentious. Some people prefer minimal road building or no roads at all. Others would like to see existing motorized opportunities improved or expanded; this is particularly true in Moffat and Jackson Counties.

Total road miles on the Routt National Forest are fewer than on other forests in the vicinity. However, additional motorized recreation opportunities are available on the Pike and San Isabel National Forests, on the Arapaho and Roosevelt National Forests, and on the Rio Grande National Forest.

Issue addressed: 11

Related questions: UR/RR2

UR6 and RR6: How does the road system affect the Scenic Integrity? How is developing new roads, decommissioning of existing roads, or changing the maintenance of existing roads into unroaded areas affecting the Scenic Integrity?

Roads such as the Rabbit Ears Pass Highway and Gore Pass Highway are rated as concern level 1, the level at which travelers have a high degree of interest in scenery. These roads can be easily traveled by anyone and offer a pleasant viewing experience of both natural and natural-appearing landscapes on the Routt National Forest. Concern level 2 roads on the Forest are those where travelers have a moderate degree of interest on scenery. Most maintenance levels 3-5 roads on the Forest are rated as concern levels 1 and 2. Some maintenance level 2 roads in the semi-primitive motorized areas are rated as concern level 1. Concern level 3 roads have a low degree scenic interest and are generally local maintenance level 1 or 2 roads.

New roads can affect scenic integrity when viewed from adjacent existing concern level 1 or 2 roads. An improperly designed new road with fresh cut and fill slopes that contrasts with the surrounding landscape would reduce scenic quality. Decommissioning existing unneeded roads can enhance the scenic integrity of the landscape. Reducing the maintenance of roads can result in visible resource damage from erosion and decrease scenic integrity. Increasing the road maintenance can ensure better protection and preservation of scenic integrity within the road corridor.

RR7: How does road management affect wilderness attributes, including natural integrity, natural appearance, opportunities for solitude, and opportunities for primitive recreation?

Roads and road use may negatively affect nonmotorized recreationists, and some people have expressed an interest in wanting roads closed or decommissioned. Although they use roads to access trailheads into unroaded areas or wilderness areas, many users perceive roads to be a deterrent to healthy wildlife habitat or unacceptable contributors to stream sedimentation. They see these unroaded areas as critical to their individual, community, or ecosystem health.

The closure, presence, or addition of new roads and their management in proximity to wilderness areas can change the natural integrity and opportunities for solitude because of differences in vistas, amounts of noise and dust, and crowding. There are concerns about ready access from trailheads on Seedhouse Road (NFSR 400), the Bear River Road (NFSR 900). Use in these areas includes daily fitness walking which affects those seeking solitude from the wilderness experience. The Red Dirt Road (NFSR 100) and the Grizzly-Helena motorized trail provide easy access to the Sarvis Creek and Mount Zirkel Wilderness Areas, respectively.

Roading and road use can affect unroaded areas under consideration for additions to the National Wilderness Preservation System. This is a concern in the Troublesome Geographic Area.

Issue addressed: 11.

Social Issues (SI), Cultural/Heritage Issues (CH), Civil Rights (CR), and Environmental Justice

SI1: Who are the direct users of the road system and of the surrounding area? What activities are they directly participating in on the Forest? Where are these activities taking place on the Forest?

In 2001, less than 1% of sampled forest visitors were from another country. The survey did not collect country affiliation. There were 77% male and 23% female visitors to the forest, 60% between the ages of 31 and 40. Recreational use of roads was discussed in UR/RR-1. In addition to age, gender, and activity preferences of visitors, the National Visitor Use Monitoring (NVUM) survey asked visitors to place themselves into one of seven race/ethnicity categories (see following table).

Table 32- Race/ethnicity of Routt National Forest recreation visitors.

Racial Category	Total percent of National Forest visits
Black/African American	0.0
Asian	1.5
White	98.3
American Indian/Alaska Native	0.0
Native Hawaiian or Other Pacific Islander	0.0
Spanish, Hispanic, or Latino	0.2
Other	0.0

The following table illustrates the type of Forest facility or opportunity visitors used during 2001 and their average length of stay (in hours). Nearly half had not used any facility or designated area (wilderness), rather they had only used the general forest area. General forest area use could include dispersed overnight or day camping, sightseeing, trail uses, or collecting forest products such as firewood cutting. This type of use is very dependent on the road system for access to special areas.

Table 33 – Number of exiting visitors by activity type (2001).

	Day Use (Developed sites)	Overnight (Developed sites)	General Forest	Wilderness
Total Surveys Conducted	176.0	83.0	275.0	55.0
Percent of Total	30.0	14.0	47.0	9.0
Average Site Visit Length (in hours)	2.6	34.0	19.6	13.4

Some roads hold more importance for forest users than others; Rabbit Ears Pass, Buffalo Pass, Seedhouse Road, Lynx Pass, California Park, Dunckley Pass, Bear River, and the road to Red Dirt Reservoir are all important roads for general access to and through the Forest. These roads are highly visible and are main access points.

Some of the concerns expressed by visitors in the NVUM include inadequate signing and mapped information. Road maintenance funding doesn't cover the installation of recreation signs; this is a concern forestwide.

Issues addressed: 4, 5, 7, 8.

Related question: AU2

SI2: Why do people value their specific access to national forest and grasslands? What opportunities does access provide?

Access is predominantly a social issue; it means more than a road or trail. People can value existing access opportunities, whether they exercise them or not. Others can value areas with limited or no opportunities for access, seeing access as negative. This question specifically addresses those people and activities identified in SI1 and UR/RR-1.

"Why do these people value their access?" Some people perceive roads to be the only means of access to forest resources, on which they may be economically and culturally dependent. The roads on the Forest were built for a combination of reasons, including recreation and commodity use. They are part of the landscape and culture of the area. For many local people, unroaded areas benefit only a few people and aren't that important to them personally. These residents see roads as imperative to the management of the Forest, either for timber production, which supports the sawmills, or for fighting fire. In these cases, the opportunity cost of not building roads into unroaded areas outweighs the cost of road development and long-term maintenance.

Some of the values people hold for an area or a forest resource are spiritual, religious, or have ties to traditional customs. Road obliteration, closure, reconstruction, or construction, or a change in management of an existing road in proximity to unique or special areas can change not only the access, but also the experience in terms of natural integrity, opportunities for solitude, vistas, noise, and dust levels and crowding in adjacent forestlands. Roads and road management maintains historic use of the Forest and introduces other users to its qualities.

Understanding why people value and desire more or less access to an area will help decision-makers understand how road management changes may impact people's current and future uses of the Forest. If a road is managed as a level 3 and the decision is made to upgrade it, more and different users might begin to use the area. This will change the character for users who consider the area to be special; it will change their experience and may displace current users to other areas for their recreation. Likewise, if a road is currently managed as a level 4 and the decision is made to downgrade maintenance, the road will not be as comfortable to drive, and the area can become inaccessible for some current users. This problem is especially evident for the elderly. Because a variety of different people use the existing road system, they need to be considered before road management changes are made.

Certain types of recreation may be road-dependent, so users want roads maintained (see the discussion in UR/RR1). Hunting is both facilitated and hindered by roads. Illegal use of roads is a concern for many hunters who may track big game for several miles on foot only to meet someone using a motorized vehicle (OHV or 4WD) on a road that is not open to motorized vehicle use. Motorized use of roads is not necessarily helpful when tracking game; however, roads are useful for packing an animal out of a remote area (see discussion in Chapter 3, Issue # 9).

Visitors to the Forest in 2001 were asked about the quality of their experience during their visit. The following table illustrates their perceptions of quality and importance of various elements of their visit to the general forest area (not including developed sites). Attractiveness of the forest landscape, condition of the natural environment, helpfulness of employees, feeling of safety, and scenery were the five most important elements of their visit. The Forest rated highest in helpfulness of employees, attractiveness, feeling of safety, condition of forest trails, and condition of the natural environment.

Table 34. Routt National Forest recreation visitor satisfaction in general forest areas.

Item Name	Item by Percent Response					Mean Visitor Satisfaction[1]	Number of Visitors	Mean Importance[2] to Visitors	Number of Visitors
	Poor	Fair	Average	Good	Very Good				
Scenery	0.0	22.1	0.0	34.0	43.9	4.0	52	4.0	46
Available parking	0.0	6.9	8.2	45.7	39.1	4.2	49	3.8	44
Parking lot condition	35.8	7.3	11.9	35.1	9.8	2.8	40	3.2	37
Restroom cleanliness	0.0	22.8	30.2	47.1	0.0	3.2	9	2.8	12
Condition of natural environment	0.0	16.4	1.8	27.6	54.2	4.2	50	4.6	46
Condition of developed recreation facilities							8		9
Condition of forest roads	4.2	33.1	13.3	36.3	13.2	3.2	38	3.1	32
Condition of forest trails	0.0	0.0	0.7	71.2	28.1	4.3	39	3.9	39
Availability recreation information	16.2	6.2	12.5	51.9	13.3	3.4	44	3.6	39
Feeling of safety	0.0	0.0	7.2	59.3	33.5	4.3	52	4.1	46
Adequacy of signage	18.0	34.5	14.2	21.5	11.7	2.7	51	3.4	46
Helpfulness of employees	0.0	0.0	0.0	17.8	82.2	4.8	38	4.2	37
Attractiveness of forest landscape	0.0	13.8	1.0	20.3	65.0	4.4	52	4.7	46
Value for fee paid							5		7

[1] Scale: 1=not satisfied 2=somewhat satisfied 3=moderately satisfied 4=satisfied 5=very satisfied

[2] Scale: 1=not important 2=somewhat important 3= moderately important 4=important 5= very important

The following table illustrates the comments about to roads and signs were received during the 2001 NVUM survey.

Table 35. Responses from the NVUM survey question: "Is there any other accommodation or assistance we could offer? Comments…"

Site Name	Is there any other accommodation or assistance we could offer? Comments
Mad Creek TH General Forest Area	Greenville Mine road / Lots of trash in hunting season
Buffalo Pass at Dry Lake General Forest Area	More motorized trails
Slavonia TH Wilderness	Signs to what campgrounds are open, closed signs for campgrounds
Dumont Lake Campground	Grade roads, don't like all the rocks in the sheep's crossing area

Site Name	Is there any other accommodation or assistance we could offer? Comments
Fish Creek Falls Day Use	No cars any where near falls, too much advertising
Hahn's Peak Lake Campground	Map at trailhead - clarification sign at fork on lower portion of trail 1156 (Prospector Trail).

Issue addressed: 9

Related question: AU2

SI3: What are the broader social and economic benefits and costs of the current forest road system and its management?

Many communities and individuals have social and economic dependencies on forest roads and the access they provide to Forest resources. Changes to a road system or to road management may affect (positively or negatively) local commuting patterns, lifestyles, forest resource-related businesses, the collection of special forest products; school bus routes, firefighting access needs in the wildland-urban interface, and access to municipal water supplies, power lines, and other local infrastructure. Some communities are more vocal than others on this topic and are highly dependent on the forest for the health of the local economy.

Road management is necessary for forest management. Commodity users rely on the existing road system, and in many cases, upgrade the roads, as part of their contract. For many communities in the West, the road system is the backbone of commerce, allowing the movement of products and people through the Forest. Many of the previously planned timber sales weren't possible because of the likelihood of building roads into unroaded areas. The current Forest Plan retained 79% of roadless areas in a roadless character.

The Routt Divide Blowdown affected the roaded and unroaded areas west of the Mt. Zirkel Wilderness Area. In response to nearly 13,000 acres of spruce and fir trees being uprooted, and an ensuing bark beetle infestation, the Forest Service logged much of the downed timber outside the wilderness area. Salvaging of the down material using the existing road system with some minor new road construction had social and economic benefits for local communities. In addition, the logging operations required better road maintenance and new roads to access cutting units; this resulted in upgrading of the road system by the contractors. The benefits of this catastrophic event went to timber industry employees near the Forest. Workers at the [now closed] mill in Saratoga Wyoming benefited because they didn't have to travel four hundred miles from home to haul logs. However, downed timber in unroaded areas was not salvaged due public opposition and concern over changing the roadless character. This demonstrates how local communities benefited from use of the road system while social concerns were also taken into consideration.

The benefits provided to communities around national forests extend beyond those who directly access or use forest resources. People owning or working in businesses in 'gateway' communities often benefit from tourism associated with people visiting the nearby national forest. Local businesses also benefit through the potential economic activity generated by resource activities like timber harvest, grazing, road development and maintenance, water projects, and other special uses. The proximity of the Forest to I-70 and the Colorado Front Range makes tourism an important part of maintaining a more diverse economy for communities around the Forest. Today, the Forest is selling less timber, but the roads are just as busy as recreation traffic increases.

Communities may benefit from tourism and the associated infrastructure development that also enhances the local quality of life. However, these developments may negatively impact surrounding resources. These "externalities" may include the overall impact to resources such as soil, water, habitat, and scenery or damage to values people hold for an area such as an unroaded character, limited accessibility, or solitude. The 1998 Forest Plan analysis indicated that a large percentage of the jobs and income generated on the Forest are due to downhill skiing, which doesn't require an extensive road system for operation.

The demographics in the U.S. are that of an increasing urban population (Cordell et al. 2000). Recreation traffic includes local and non-local users, many of whom are sight seeing. Across the National Forest system, managers have indicated that nearly 40% of Forest use is by people who never get out of their vehicles. These travelers expect to go long distances in short amounts of time and to be able to get through the Forest in comfort. With the exception of the state highways, there are no paved roads on the Forest. However, a number of roads have been built for comfort and safety. Maintenance is increasingly important to meeting the expectations of these users—users who are replacing commodity production in the overall economic health of local communities.

Passive use, or indirect use values, are identified in some project level assessments (comments) and from direct contact with forest visitors. Ethnic groups, subcultures, tribes, national interest groups, and local residents can hold cultural, spiritual, sacred, traditional symbolic, or religious values associated with access to specific places, opportunities, or resources on the Forest. The groups most commonly heard from on projects are those who are directly affected by a project or special interest groups representing an particular segment of the population. People who comment might be from other parts of the country, but they hold intrinsic values for forestlands and management of the National Forests.

The 1997 Routt Forest Plan identified special areas on the Forest: Wild and Scenic Rivers, Research Natural Areas, and Special Interest Areas. There are five rivers or streams recommended for inclusion in the National River System as either wild or scenic. They are the Elk and Encampment Rivers, Rock Creek, Roaring Fork/Red Canyon, and the North Platte River (see Forest Plan FEIS Appendix E). All of these segments are accessible by Forest roads.

There are three Research Natural Areas (RNAs): Kettle Lakes, Mad Creek, and Silver creek. Kettle Lakes is the most susceptible to motorized encroachment, as some of the RNA is outside the wilderness boundary and near a motorized trail. Most of the three RNAs are inside designated wilderness areas and are not susceptible to changes in existing road management (see Forest Plan FEIS, Appendix F). However, winter motorized use poses a threat to these areas where they are easily accessed from snowmobile trails or road corridors.

Finally, there are seven Special Interest Areas (SIAs): Teller City, Camp Creek, Windy Ridge, Encampment River, Little Snake, Black Mountain, and California Park (see Forest Plan FEIS at page 3-190). These areas were selected because of their unique characteristics and the agency's desire to protect these values. Where appropriate, public education and interpretation are emphasized and developed in these areas.

Level 3, 4, and 5 roads lead to other important areas off level 2 roads, and generally dispersed recreation sites. Well-developed and regularly used dispersed campsites can also be considered special areas. Dispersed camp and recreations sites that are close to rivers and lakes are a source of concern. Since water serves as an amenity to most campers, removing these campsites may be a last resort; cleanup, revegetation, and rest can help mitigate resource problems.

The National Survey on Recreation and the Environment

The USDA Forest Service completed its Strategic Plan (2000 Revision) in October 2000. The goals and objectives included in the Strategic Plan were developed with input from the public, some of which was obtained through a telephone survey. The Results Act requires an agency to ask for the views and suggestions of anyone "potentially affected by or interested in" its Strategic Plan. The long-term goals and objectives of the Strategic Plan must therefore reflect not only the agency's mission, but also the public's views and beliefs for our country's forests and grasslands. A telephone survey randomly selected members of the American public who were asked about the following:

- Their **values** with respect to public lands.
- Their **objectives** for the management, use and conservation of forests and grasslands.

- Their **beliefs** about the role the USDA Forest Service should play in fulfilling those objectives.
- Their **attitudes** about the job the USDA Forest Service has been doing in fulfilling their objectives.

The following discussion is based on 7,069 responses to the NSRE phone survey.

The American public is divided in its opinion about the provision of access, as evidenced by the difference between support for motorized access and support for nonmotorized access. Motorized recreation is not a high priority objective, while preserving the ability to have a "wilderness experience" is important.

The expansion of off-highway motorized access and the development of new paved roads are somewhat unimportant objectives and trails for motorized access are slightly unimportant to the public. Contrast this with the provision of nonmotorized access, which is viewed as a somewhat important objective to the public.

The provision of increased access for motorized recreation is seen as a slightly unimportant objective for public land management and is also viewed as a slightly unimportant role for the USDA Forest Service (NSRE 2000). Non-metropolitan easterners and metropolitan westerners see motorized access as a more important objective than do non-metropolitan westerners and metropolitan easterners. Agency performance in the area of motorized recreation is viewed as somewhat favorable, except in the case of off-highway motorized access, where the agency role and performance are rated as slightly unfavorable.

The agency is viewed as doing a somewhat favorable job providing nonmotorized access. Support for nonmotorized recreation opportunities is stronger in metropolitan areas than non-metropolitan areas. Separating these often conflicting types of pursuits by designating trails for specific uses is seen as a somewhat important objective, with higher support outside of metropolitan areas.

Issue addressed: 6.

SI4: How does the road system and road management contribute to or affect people's sense of place?

Sense of place describes the character of a physical location and the meaning, value, and feelings people attach to it because of their experiences there. It integrates interpretations of a geographic place, including the biophysical setting, psychological influences (memory, choice, perception, imagination, emotion), and social and cultural influences. Changes in road management can affect access to these special places or change their biophysical setting, affecting people's sense of place and what they value or desire in an area.

People's sense of place is directly tied to the characteristics of an area that invoke a special feeling of attachment to the area. Factors may include the area's vegetation, fish and wildlife resources, amount of sunlight available, views, solitude, opportunities that make it a destination, and the overall familiarity to an individual or group. Roads often facilitate a person's enjoyment of the area by providing for driving comfort, the amount and type of use, and any number of aesthetic attributes visible alongside the road. Sometimes the road itself is the place a person enjoys. People have local names for specific roads, they enjoy driving specific routes, and consider such driving activity a part of their connection with an area. These attributes are directly tied to road management. Any changes in this management will likely change people's sense of place and impact current uses.

Special places on the Forest most likely to evoke an emotional response if management were to change include:

Black Mountain	Fish Creek Falls	Morrison Creek
California Park	Buffalo Pass	Teal Lake
Columbine	Big Creek Lakes	Illinois Creek
Seedhouse	Bear River	Flat Tops National Scenic Byway (NFSR 16)

Issue addressed: 5.

SI5: What are the current conflicts between users, uses, and values (if any) associated with the road system and road management? Are these conflicts likely to change in the future with changes in local population, community growth, recreational use, resource development, etc?

Conflicts often occur between different types of users – motorized vs. nonmotorized, hunting/fishing vs. nonconsumptive users, recreational users vs. tourism, and resource preservation vs. resource extraction, and within uses (e.g., motorized vs. nonmotorized hunting). Understanding these conflicts provides needed context for road management, enabling decision-makers to predict the social effects of their decisions with regard to existing conflicts. It will also help decision-makers formulate road management decisions that may help resolve or mitigate these conflicts.

Conflicts on the Routt are forestwide, and include the following:

- Conflicts between road users – commercial vs. public wanting high standard roads.
- Concerns over the public using private access within the Forest boundary.
- Motorized users in areas where nonmotorized use is popular (year-round).
- Ineffective closures allowing motorized access.
- OHV use on the same roads as other vehicles (that are street legal).
- Conflicting policies on roads with concurrent jurisdiction.

These conflicts will only increase in severity and geographic distribution as use levels increase. They are also increasing as more subdivisions are developed inside and adjacent to the Forest. The populations in communities around the Forest continue to grow and change in character. Many of the newcomers are retirees and support staff for tourism-based industries. The growth of nearby communities will probably increase Forest use as well. This will create more conflict between users, as well as demands for levels of road maintenance on the main arterial and collector roads.

Issues addressed: 1, 5, 10

Related question: GT4

CH1: How does the road system affect access to paleontological, archaeological, and historical sites and the values people hold for these sites?

Access to paleontological, archaeological, and historical sites provides opportunities for studying, learning about, and enjoying our natural history and cultural heritage. People want different experiences at resource sites. Some people want roads to go right to the sites for ease of access and quick visits. Others prefer to have road access near paleontological and cultural resources but not visible from the sites so the feeling of the site is more as it may have been in the past. Others seek sites that are far from roads and trails so they can experience the feeling of discovery and the perception of being one of the few to visit the site. American Indians often prefer that roads not be visible or audible from sites they consider sacred. Lack of roads to a site is unlikely to stop a scientist from studying a resource of interest.

Routt National Forest cultural resources provide an array of experiences. The following are some of the more popular cultural resources: the Mad Creek Barn, with the nearby Heinze Homestead and cabins along Mad Creek; the Hahns Peak Lookout (from FSR 490); and the Windy Ridge Quartzite Quarry (from FSR 100). Reaching these sites requires hiking. Other cultural resources, like the guard stations and Teller City (along FSR 740), have roads for passenger vehicles leading directly to the sites. At present, the public has not expressed interest or concern in closing or opening additional roads to specific cultural sites on the Forest.

Access to paleontological, archaeological, and historical sites also increases risks of unintended physical damage, artifact and fossil collection, and site vandalism. Closing roads usually improves protection of paleontological and cultural resources by decreasing the number of people in the area, thereby reducing artifact and fossil collection and other forms of site damage. Opening new roads, conversely, exposes these resources to increased visitation and possible site damage, especially sites within ¼ mile of the road corridor (Nickens 1981).

If maintenance actions, including plowing snow, stay within previous disturbance, vertically and horizontally, road maintenance has no potential to cause effects, as defined in 36 CFR 800.3(a)(1) for Section 106 of the NHPA. If the action needs to expand beyond previous disturbance, a cultural resource assessment is needed for that area. Indirect effects, such as collecting, may be mitigated by better education/information.

CH2: How does the road system and road management affect the exercise of American Indian treaty rights?

Eastern Shoshone: On July 3, 1868, the Eastern Band of the Shoshone and the Bannock signed a treaty at Fort Bridger. In this treaty the Shoshone ceded all rights to lands in Colorado and accepted lands reserved for their exclusive use in the Wind River area of Wyoming. This treaty terminated all Shoshone treaty rights to lands administered by the Routt National Forest.

Ute Bands (Northern Ute, Southern Ute, and Ute Mountain Tribes): In 1880, Congress ratified an act (June 15, 1880) to purchase all lands within Colorado from the confederated bands of the Ute Indians. In part, the act required that the Ute Bands be moved to the reservation along the La Plata River or to the Uintah Reservation in Utah. This congressional act terminated all Ute treaty rights to lands administered by the Routt National Forest.

Summary: Although Tribal treaty rights have been terminated on lands administered by the Routt National Forest; the Forest has a trust responsibility to tribal governments, brought about by treaties and federal laws. Access to medicinal plants, minerals, and sacred or spiritual places are the most important trust rights. The road infrastructure allows Tribal members access to exercise these rights.

CH3: How does road use and road management affect roads that constitute historic sites?

The first standard of the *Secretary of the Interior's Standards for the Treatment of Historic Properties* states a property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the property and its setting. Therefore, using roads for their intended purpose helps maintain the roads' historic character. Bridges and other structures and sites related to the roads may also be significant. Currently, some historic roads are not being used for their intended purposes and/or the amount of use may be different . This can affect the road's historic character and structural integrity.

Maintenance of historic roads has no potential to cause effects, if maintenance actions stay within previous disturbance, vertically and horizontally, and the important characteristics of the road (design, setting, location, materials) are not changed.[5] Maintenance can potentially benefit historic roads by reducing erosion.

[5] 36 CFR 800.3(a)(1), Section 106 of the National Historic Preservation Act (NHPA)

Road upgrades can change the design, setting, location, and/or materials that convey the quality of the site during its period of significance. For example, a narrow, winding road providing the only entry to a remote agricultural valley would no longer convey the same experience if it was straightened, widened, and paved.

Important historic roads are managed most efficiently and effectively if they are identified, recorded, and evaluated early and at a larger scale; for example, the forest scale rather than the project scale. Presently, historic roads are assessed at the project level for compliance with Section 106.

The following is an opportunity to protect historic roads:

- Negotiate a programmatic agreement (PA) with the State Historic Preservation Office (SHPO) to identify important Forest roads through archival research, then survey (to record the historic road and to record archaeological and historical resources along the road), record, and evaluate only the roads with the potential to be eligible to the National Register of Historic Places (NRHP).

CR1: Is the road system used or valued differently by minority, low-income, or disabled populations than by the general population? Would potential changes to the road system or its management have disproportionate negative impacts on minority low-income, or disabled populations?

All people are affected by changes in road management and the access afforded by roads. The road system is used by all groups of people traveling to and through the Forest. Changes in road management, including closing or decommissioning of any of the roads would have the same effect on all groups, including minorities and different cultures. More importantly, the effects are directly related to the reason for using the road.

The National Forest provides a relatively inexpensive recreation experience compared to more costly urban recreation opportunities. For example, current recreation fees average no more than $10.00 per car.

The Routt National Forest does not discriminate against any group or persons based on color, creed, abilities, nationality, or background. All persons are treated equally in policy and management of the National Forest. Travel management is no exception. The rules, standards, and laws that govern how the travel system is developed and used apply equally to all that use it.

The following direction addresses access by persons with disabilities:

Section 504 of the Rehabilitation Act of 1973

"No otherwise qualified person with a disability" in the United States shall, solely by reason of his disability, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance or under any program or activity **conducted by any Federal Executive agency or by the United States Postal Service".**

7CFR 15e. 103(iii)(2)

"Further the person with the disability must be able "to achieve the purpose of the program or activity without modifications to the program or activity that **fundamentally alters** the nature of that program or activity".

It should be noted that the term **"reasonable accommodation" in regard to disabilities** is only used in reference to employment. There is no such requirement for program access, which would include access to the national forests.

OHV access by persons with disabilities:

There is no legal requirement to permit a person with a disability to utilize an OHV in any area that restricts or prohibits OHV use under the Forest Plan or the Forest Travel Plan/Transportation Plan.

Related question: UR/RR1.

Winter Use (WU)

Winter Use 1 (WU1) Routt Supplemental Analysis Question: What are the potential effects of using the road system during winter, including authorizing snow removal?

Historically winter vehicle use of the road system has been restricted by snow. However, winter use of the road system to access private inholdings is increasing. The courts have ruled that the Forest Service must provide private inholders with reasonable access, which may or may not mean year-round access. The Alaska National Interest Lands Conservation Act (ANILCA) provisions include "access for the reasonable use and enjoyment of their private land." For additional discussion of ANILCA, see GT3.

A special-use permit is the standard procedure for granting access across NFS lands to private inholdings. These permits are subject to terms, provisions, and conditions that will safeguard adjacent forest resources and may include limiting access to only the permittee. As of 1983, 43 rights-of-way had been acquired, with an additional 51 applications filed on the Routt National Forest (1997 Routt Forest Plan EIS).

There are engineering, safety, social, and environmental (watershed and wildlife) concerns associated with snow removal and/or use of the road system during the winter. Most National Forest System roads are designed and constructed for use during the normal operating season, meaning the time of year when the road subgrade is in an unsaturated condition. The normal operating season varies by climate conditions, aspect, and elevation. On the Routt National Forest, the normal operating season is from spring snowmelt in May-July (depending on elevation and snow depth) to the first major snows, which can start as early as October. The concerns addressed here are for use of the road system following the first major autumn snows which would typically close the road system, through spring snowmelt and a return to unsaturated conditions or the normal "summer" use period.

Engineering concerns: Even light vehicle traffic can cause considerable damage when the road surface and subgrade are saturated. To prevent this damage, aggregate surfacing, additional drainage features, widening of the clearing limits, or other measures needed to strengthen the road may be necessary. Restricting vehicle use during thawed conditions helps protect the road surface and subgrade. When this is not feasible, measures to strengthen the road may be necessary.

It may be necessary to evaluate the existing road design for its ability to support winter use. Some design criteria to consider include turnout spacing, intersection radius and grade, sight distance on approaches, approach grades (especially at highway and county road intersections), road template (insloping or outsloping roads), and road grade. The design and critical vehicles may be different for winter and summer use.

Plowed roads can attract additional traffic. For plowed roads, it is important to design adequate turnaround space at the end of the plowing and before any closure devices.

Opportunities and guidelines to address engineering concerns include the following:

- When issuing easements, contracts or permits to plow roads during the winter or authorize use outside the normal operating season, consult appropriate engineering staff to determine the need for reconstruction, maintenance and snowplowing requirements.
- Attach standard specification 803 or equivalent to all authorizations for snow removal on roads. The specification may be accessed at http://www.fs.fed.us/database/acad/dev/roads/803.doc. Timber sale contracts address snow removal through the regional C-provision RO-C(T)5.36# - Snow Removal(9/01).
- Upgrade the road surface as needed to accommodate use during saturated and thawing conditions.
- If there is inadequate parking and turnaround space at the end of a plowed road section, consider restricting winter use to only the permittee.

Safety concerns: Many roads serve as snowmobile and cross-country ski trails during the winter. Authorizing snow removal can create unsafe conditions for the public. Appropriate signing to designate acceptable use should alert users to mixed traffic use.

Since the existing road system was designed for 'summer' use, there may be safety concerns at intersections during winter conditions including sight distance and approach grades.

Opportunities to address safety concerns include the following:

- Consider requiring marking and signing roads, adding turnouts, and constructing alternative trails for winter use when the road width and geometry does not provide safe passage for mixed traffic.
- Reconstruct or relocate intersections to attain approach grades appropriate for winter conditions. Intersection approach grades that are adequate in dry conditions may be too steep to negotiate on snow-covered roads.
- Construct snow berms (removal, etc.) to avoid impacting sight distance, particularly at intersections.

Social concerns: Year-round access changes recreation in areas not previously accessible by motor vehicles. Cabin owners have begun using their cabins year-round. This off-season use increases overall use levels and changes use types. Winter experiences can be changed for nonmotorized recreationists seeking quiet landscapes. This group has to adapt their winter expectations to the new and higher use levels.

It is important for recreation professionals to keep abreast of new activities being attempted by users, due to improvements in technology. New demands for year-round access include a request by a four-wheeling user group to drive on forest roads with deep snow cover. The objective of this activity appears to be getting stuck in the snow and then getting unstuck. These users would like an exclusive use designation, something that should be coordinated with other winter use activities. Where the road has specific uses previously designated (such as for snow machines or cross-country skiing), other activities such as four-wheeling should be prohibited in a seasonal closure order. A winter trail inventory would be helpful in identifying areas where closure orders are needed.

When new uses develop and people become accustomed to using them, it is difficult for the Forest to later restrict the use. If people expect roads to be kept open, they'll be more likely to drive on them in less than desirable conditions and at less than desirable times. The vicious circle begins with the need for more regulations, as users are less apt to agree to give up their opportunities the longer they have them.

Opportunities to address social concerns include the following:

- Identify and inventory the winter trail system. Develop closure orders to prohibit incompatible uses on the winter trail system.
- As new uses develop which are inappropriate due to effects on resources or social concerns, restrict these uses before they become part of the winter use 'culture.'
- Include use of the road system in winter travel management plans.

Environmental concerns: The primary environmental effects of snow removal and winter use of the road system are to wildlife, and the soil and water resources.

Soil and water: The unrestricted use of roads during wet weather and winter can result in rutting and churning of the road surface. Runoff from such damaged road surfaces carries a high sediment load. The damage and maintenance cycle for roads that are frequently used in winter can create a disturbed road surface that is a continuing source of sediment (USDA Forest Service 1988). Snowplowing can affect spring runoff processes by developing berms. Berms are defined as a dike of snow, resulting from snow removal operations, which extends above the surface of the traveled way. Berms on the edge of the road prism trap and concentrate water on the road surface rather than allowing water to flow across the road prism. This further reduces dispersed flow of water down the hillside, and increases the concentrated surface flow which reaches the channel faster than subsurface flow.

On roads where snowplowing occurs, plowing of snow directly into the stream channel at road-stream crossings could result in the development of ice-dams. These ice-dams reduce channel capacity and the ability to convey water. This can result in culvert failure, and/or can cause channel migration as water is forced out of the channel in seeking a route around the ice-dam. The channel migration can result in the development of a braided channel since the areas outside of the channel may not be resistant to the erosive forces of water.

Opportunities and guidelines to reduce the effects of winter use on the soil and water resources include the following:

- Do not plow snow and debris directly into stream courses.
- Remove or breach snow berms created through snowplowing to avoid accumulating or channelizing melt water on the road and to prevent water concentration on erosive slopes or soils. This should include an adequate number of breaches or breaks in the snow berm to allow frequent drainage of water from the road surface. Spacing of the breaches is highly dependent on slope, soil type, and road design.
- Suspend or limit road use of the road to colder portions of the day when the road surface is frozen. Suspend road use when ruts exceed three inches in depth for a length of 100 to 200 feet, depending on grade. If this is a problem, upgrade the road surface to a standard so that rutting does not occur.
- Mark all culverts and low water crossings prior to snowfall. Ensure that the culverts and crossings are open and functioning throughout the winter and at the beginning of spring snowmelt.
- Plow the road surface when temperatures are consistently below freezing to promote freezing of the road. This will remove the insulation provided by the snow allowing the subgrade to freeze to a greater depth and reduce road surface damage that might occur from use during unfrozen conditions.
- On roads where snowplowing occurs, remove all snow fills and restore the natural stream crossing on any natural stream or low-water crossing prior to spring snowmelt to prevent the development of ice-dams.

Wildlife concerns: Snow plowing can impact wildlife in three ways. First, these compacted snow routes facilitate the movement of competing carnivores (i.e. coyotes, bobcats, foxes) into lynx habitat (Buskirk et al. 2000). In the absence of roads and trails, snow depths and snow conditions normally limit the mobility of lynx competitors. Plowing roads nullifies the competitive advantage of lynx by allowing habitat generalists access to areas normally blocked by deep snow. Lynx possess adaptations to travel through deep snow in order to out-compete habitat generalists like the coyote and bobcat. Thus, plowing roads on the Routt NF puts a threatened species, the lynx, at a disadvantage by artificially reducing the quality of its habitat and increasing its competitors' available habitat.

Secondly, as described in the Social Concerns section above, plowed roads invite increased winter use to areas previously not accessed. In some areas, plowing roads would increase access to new terrain for snow mobile and ski activity. By creating new staging areas, snowmobile users and skiers can access areas that were previously less accessible. This creates new areas of concentrated use and increases the area impacted by snow compaction.

The tracks of compacted snow created by these activities can be detrimental to those species dependent on the insulating capacity of snow. For instance, amphibians and many small mammals hibernate below the frozen topsoil during the winter. The depth of frozen topsoil is correlated with the depth of snow. All things being equal, when snow is compacted, the soil underneath will freeze deeper than if the snow were not compacted. This can directly impact hibernating wildlife. In addition, some small mammals, such as the meadow vole, remain active all winter long by using the insulated environment in the space between snow and soil (Jarvienen and Schmid 1971, Halfpenny and Ozanne 1989, Pruitt 1960). Snow compaction can either eliminate this space or reduce the temperature within this space, thereby increasing the energy expenditure required by the meadow vole to thermoregulate. Finally, snow compaction can change the timing of snowmelt. Early snowmelt can result in the flooding of subnivian tunnels, forcing meadow voles out into the extreme temperatures of the ambient air and exposing them to predators.

Lastly, plowed roads facilitate increased human activity (see Social Concerns) in wildlife habitat during a critical season for wildlife. Winter tends to stress animals more than any other season because food is scarce and energy expenditures for staying warm and traveling through snow are high. Human activities facilitated by plowed roads can disturb many wildlife species. Disturbance can result in stress and displacement of animals (Cassirer et al. 1992, Ferguson and Keith 1982, Freddy et al. 1986). Constant disturbance can result in changes in behavior, abandonment of territory (Anderson et al. 1990, Knight and Cole 1991) and even death of animals (Leptich and Zager 1991).

Issues addressed: 5, 10

Opportunities and guidelines to reduce the effects of winter use on wildlife include:

- Consider restricting winter use to only the permittee.
- Consider restricting snow-compaction activities like snowmobile riding from staging areas made newly accessible by snow plowing. This likely is most important for wet meadows and riparian areas where species vulnerable to snow compaction (e.g., amphibians, meadow voles) are most likely to occur.

Chapter 5 Describing opportunities and setting priorities

Problems and Risks Posed by the Current Road System

Introduction

This chapter identifies opportunities to address problems and risks posed by the current road system and integrates the issues identified in Chapter 3 with the assessment of benefits, problems, and risks identified in Chapter 4. Opportunities and guidelines for addressing each issue are identified to help prioritize and guide subforest scale analyses.

The problems and risks posed by the current maintenance level 3-5 road system on the Routt National Forest were evaluated using a GIS assessment, a road matrix, and a road management graph. As with any database-based analysis, there were some inherent limitations in the data used. The information used represents the most current data available as of January 2003.

GIS Assessment: The effect of roads on the wildlife, watershed, and aquatic resources was analyzed using Geographic Information System (GIS) technology in conjunction with the Forest transportation inventory and other resource-related spatial information. This analysis was not limited to the effects of level 3, 4, and 5 roads; all roads currently inventoried on the Forest were included. Areas with high road densities were identified and assessed for potential risk to the aquatic and wildlife resources.

The Road Matrix lists each segment of every maintenance level 3, 4, and 5 road on the Forest and assigns a rating of low, moderate, or high for both values and risks. This is a broad assessment, so the accuracy of road risk and values contains a degree of subjectivity and potential for inaccuracies. However, this road matrix provides road-specific information that will help define the potential minimum road system, identify roads that pose high risk to other resources, and prioritize subforest scale projects. As more information becomes available, the road matrix information should be validated and updated.

The Road Risk-Value Graph was developed to display the information in the road matrix. It categorizes the values and risks of the current road system and helps identify opportunities for managing the road system and prioritizing expenditures of Forest road maintenance and improvement funds. This graph is only a management guide; it is not firm direction as it combines many of the road matrix risk and value variables.

Resource Risks versus Road Use Values

The risks and values from the road matrix, and the road management graph are defined below.

Road-related Risks

Watershed and Aquatic Risks by 6th-level watershed: The watershed and aquatic resources were evaluated for risks from road-related impacts. In a given watershed basin, aquatic health depends on watershed health. The GIS assessment compiled the following information by 6th-level watershed:

Geologic hazards	Miles of road on sensitive soils
Soil types	Proximity of roads to streams
Road densities	Number of road-stream crossings on USGS blue-line streams
Critical aquatic habitat	Location of TES aquatic species relative to maintenance level 3-5 roads

Each 6th-level watershed was assigned a low, moderate, or high risk rating. This was intended to guide subforest scale analysis. This information was then used to determine watershed and aquatic risk (see accompanying watershed and aquatic risk table in Appendix A) for each 6th-level watershed.

A separate analysis evaluated the potential effects of level 3-5 roads on the watershed and aquatic resources, and the individual roads were assigned a risk rating in the road matrix.

Watershed matrix risk ratings: The watershed matrix risk rating addressed the physical risks of each road to the soil and water resources. The road matrix risk rating considered the miles of road adjacent to the stream system, miles of road of sensitive soils, and number of road-stream crossings. Due to the varying length of roads, the relative percent of road affected by each factor was considered rather than absolute miles.

Riparian and aquatic matrix risks: This rating focused on aquatic and riparian-dependent species. In the road matrix, roads were given a high risk rating where there were 1) potential migration barriers at road-stream crossings for fish or amphibians, 2) the road is adjacent to populations of sensitive aquatic species, 3) there is a high potential for snow compaction to affect species that use subnivian space, or 4) there is high potential for the road system to affect riparian dependent species. The sensitive aquatic species considered include Colorado River cutthroat trout, boreal toads, wood frog, leopard frog, and Rocky Mountain capshell snail. Similar to the watershed ratings, determination of high, moderate, or low depended on what percent of a given road segment had potential effects on aquatic or riparian dependent species.

Wildlife Risks: Many scientific studies have documented impacts of roads on wildlife including direct mortality, habitat loss and/or reduced available habitat due to road avoidance, habitat fragmentation, edge effects, increased competition and predation from edge-associated species, population isolation, nesting and rearing disturbances, and reduced habitat effectiveness – all of which can adversely affect viability and sustainability of wildlife populations. These factors were used to evaluate wildlife risks (see Appendix H).

Financial Risks: Annual maintenance and deferred maintenance costs were included in the risk categories for the road management graph. These costs were included to reflect the Forest's financial commitment to maintain the road system and to identify the link between maintenance and resource protection. If basic annual road maintenance (e.g., drainage maintenance) is not performed, roads have an increased potential for loss of investment and environmental damage. The same is true for deferred maintenance, such as replacing

major culverts in perennial streams at the end of their design life. A catastrophic drainage failure will have a direct negative impact on the associated watershed and aquatic health.

Road-related Values

Resource Management Value: This value was based on the variety of land and resource management access provided by the road. Value was determined by looking at resource management use and recreation use. In some cases, the road is needed for access but not necessarily as a maintenance level 3-5 road. For example, a road may access a timber management area, but a level 1-2 road, which would be used intermittently, would provide sufficient access. To differentiate roads which provide critical access but don't necessarily have to be maintained as a level 3-5 road, the matrix rating is shown with lower-case letters; for example, a road providing critical access to an area for management purposes but where a level 1-2 would meet the access requirements would be given a resource value rating 'h.' This signifies that the access provided by the road is of high value, but it would still meet management needs if it were maintained as a level 1-2 road. Reducing the maintenance level from 3-5 to 1-2 would reduce the annual and possibly deferred maintenance costs, while retaining the access value of the road for resource management.

The following criteria were used on a road-by-road basis to determine the value for different resource management and administrative needs:

Timber/insect and disease value

- Access to suitable timber base.
- Access to treat beetle infected areas.
- Access to treat stands at moderate or high risk of beetle infestation.

Fire/fuels value

- Access to high-density urban interface areas for fire suppression.
- Access for fuel reduction projects.

Administrative and permitted use values

- Access to private land.
- Existing or potential legal right-of-way to NFS lands.
- Access to key administrative facilities.
- Access to water production or storage facilities.

These criteria were used either alone**,** in cases where one use was very important for management of that resource**,** or in combination where the road served two or more access needs.

Recreation Use Values: The value of recreation use of the road system was rated separately since access for recreation affects the general public, whereas resource management is directly related to managing forest resources. High values were assigned to roads that provided direct access to developed recreation sites or were key recreation access roads to the Forest. Moderate to high values were assigned to dispersed recreation areas along roads with heavy summer and fall use. Low values were often assigned to roads that provided only seasonal dispersed recreation use.

Road System Modification Options

After performing a road-by-road rating of risk and value based on the established criteria, the following road management categories and graph were developed to display the information and present opportunities for road management. The matrix, along with the watershed and wildlife assessments, provides a basis for subforest scale roads analyses. The graph helps identify roads that make up the potential minimum road system, roads that may need additional investment to protect the resources, and roads that could have their maintenance level reduced or be decommissioned.

Road Management Categories and Graph

The following four categories of roads were identified based on value and risk. Within each category, there are several possible management options for the roads.

Category 1: High Value and Low Risk – Ideal Situation

Options:

- Focus road maintenance funds on these roads to keep them in this category.
- High priority for the Public Forest Service Road designation.
- These roads form part of the potential minimum road system for the Forest.

Category 2 – High Value and High Risk – Priorities for Capital Improvements

Options:

- High priority for subforest scale roads analysis to identify high risk reduction needs.
- High priority for capital improvement funding, such as PFSR designation, road improvement, road relocation, funding, capital improvement program, etc.
- Shift road maintenance funds to these roads to keep their resource risks from increasing.
- These roads are also part of the potential minimum road system for the Forest.

Category 3 – Low Value and High Risk – Priorities for Risk Analysis

Options:

- High priority for subforest scale roads analysis to identify high-risk reduction needs and confirm use value.
- Potential for reducing maintenance level.
- High potential for decommissioning.

Category 4 – Low Value and Low Risk – Priorities for reducing Maintenance Level

Options:

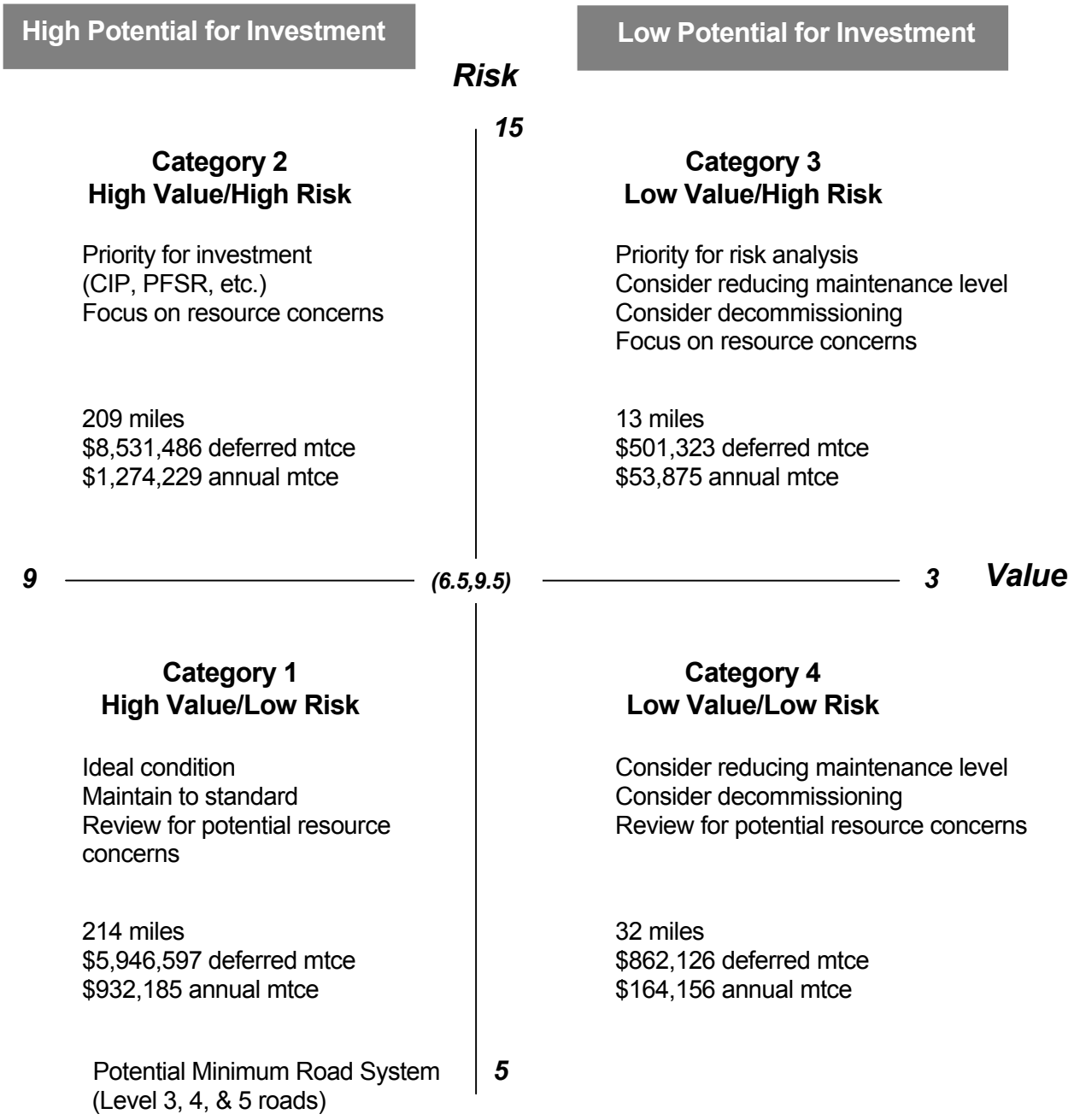
- Lowest priority for expending annual road maintenance funding.
- Moderate potential for decommissioning or reducing maintenance level.
- Where there is a recreational demand, convert these roads to trails.

The Road Risk-Value Graph (see following page) places each road into one of the management categories. Several factors need to be understood to correctly interpret this graph and identify why roads were placed in different categories.

Roads with a value of more than 6 (left side of the vertical axis) constitute the potential minimum road system for management and use of the Routt National Forest. Those roads with a value of 6 or less are potentially not needed for the Forest, at least not at their current maintenance level. The situation is similar for the horizontal axis. Those roads with a risk rating of 10 or more may be causing unacceptable resource impacts, while those with a rating of less than 10 are not as much of a resource impact concern.

It needs to be emphasized that just because a road falls below the horizontal axis does not mean it is not causing resource impacts. The risk values are a sum of the risks: wildlife, watershed, annual maintenance and deferred maintenance costs. Low costs and higher resource risks could still result in an overall rating of less than 10, low risk, on the graph. The road matrix needs to be used with the graph to identify the actual risks that have been assessed through this analysis.

Road Risk-Value Graph



Note: Not to scale.
Value = Recreation value + Resource mgmt value +Fire and Fuels value (max = 9).
Risk = Watershed/aquatic risk + Wildlife risk +Riparian and Aquatic Species risk + Deferred maintenance + Annual maintenance (max=15).
Horizontal axis: Value of 6 or less = low potential for investment (low value).
Value > 6 = high potential for investment (high value).
Vertical axis: < 10 = low risk. 10 or greater = high risk

Road Maintenance Costs – Identification of the Potential Minimum Road System

A roads analysis helps identify ways to more efficiently spend the limited road maintenance dollars allocated to the Forest. One approach is to reduce or eliminate expenditures on roads that are not needed or not needed at their current maintenance level. The process described above identifies the potential minimum (Level 3, 4, and 5) road system.

Some conclusions can be made by comparing annual road maintenance funds needed for each road to the road maintenance graph on the following page. If all of the roads to the right of the vertical axis were to be decommissioned, the needed annual road maintenance funding for just the level 3, 4, and 5 roads on the Forest would be reduced from $2,424,400 to $2,206,400. The actual allocated road maintenance funding for the entire combined Medicine Bow-Routt National Forests and the Thunder Basin National Grassland has been around $2,000,000/year. If allocated proportionally by miles, this analysis area would receive 28% or approximately $560,000. More road maintenance funding is needed to support the road system infrastructure.

Decommissioning Guidelines

Discussion

Road decommissioning results in the removal of a road from the road system. The goal is to return the roadway to a more natural state where the roadway is hydrologically self-maintaining and to permanently remove it from the transportation system. To accomplish this, a number of techniques can be used, such as posting the road closed and installing waterbars or earth berms, posting and installing barriers and barricades, ripping and seeding, scattering slash or boulders, planting vegetation in the roadway, converting the road to a trail, and full reclamation by restoring the original topography. There is a different cost associated with each of these techniques, and their effectiveness for deterring unauthorized motorized vehicle use varies as well. Planning for the location of the closures is important in ensuring their effectiveness.

Decommissioning level 1 and 2 roads can consist of removing the few culverts, ripping and seeding, posting closed with signs, and installing waterbars to discourage unauthorized motorized vehicle use and ensure proper drainage over time.

Decommissioning level 3, 4, and 5 roads is more expensive than decommissioning most level 1 and 2 roads. When choosing a technique for road decommissioning, the objective is to eliminate the need for future road maintenance.

Level 3, 4, and 5 roads are usually wider than level 1 and 2 roads, have culverts installed at designed intervals to cross drain the road, are ditched, have better sight distances designed on horizontal and vertical curve, have larger cuts and fills, and are designed through the topography rather than with the topography. It is much more expensive to decommission these roads than level 1 and 2 roads. Given the cost, it may be cheaper to maintain level 3, 4, and 5 roads than to decommission them. However, future maintenance costs may not be the only factor to consider; other resource considerations may outweigh the cost. For a particular road (level 3, 4, or 5), high deferred maintenance costs may exceed the costs of decommissioning.

Guidelines

- Balance cost with resource risk and effectiveness of the treatment when selecting methods for decommissioning roads.
- Convert roads to trails as a decommissioning method when analysis of recreation demand indicates a need to expand, connect or improve the existing trail system in the area. Provide adequate trailhead parking as part of this treatment method (See UR1 and RR1 discussion in Chapter 4).
- Decommission by restoring the road to original contours when mitigating visual impacts is required by the forest plan or when necessary to assure the elimination of vehicular traffic.

Capital Improvement Guidelines

Discussion

This analysis shows a need to reconstruct existing roads to correct deferred maintenance work items or improve some roads to meet the increasing use and traffic requirements. Funding limitations require prioritization for reconstruction work. The Road Risk-Value Graph provides a starting point for developing priorities. The following guidelines are to be used in conjunction with the graph when selecting, prioritizing, and implementing road reconstruction and construction projects.

Guidelines

- Conduct road location reviews prior to all new construction and road relocations. Ensure the location meets public and agency needs while mitigating environmental impacts identified in the analysis. Responsible line officers and resource and engineering specialists should participate in the review.
- Establish a traffic counting program to identify high-use roads and traffic patterns.
- Consider reconstruction to two lanes for roads with seasonal average daily traffic volumes exceeding 400 vehicles per day.
- Use motor vehicle accident safety investigations and reports to help identify road safety hazards.
- Use the following categories to prioritize road investments planned to reduce deferred maintenance backlog on roads: 1 – Critical Health and Safety; 2 – Critical Resource Protection; 3 – Critical Forest Mission. Data for these work items can be found in the Infrastructure database.
- Coordinate reconstruction and construction work with other agencies whenever possible. Utilize interagency agreements to develop investment and maintenance partnerships.

Road Management Guidelines

- If a road's maintenance condition has decreased, consider the need for the road and the historic use, as well as alternative roads in the area, before permanently changing the maintenance level. Use the Road Management Objectives (RMOs) to document any changes.
- Reduce the maintenance level on identified low-value level 3, 4, and 5 roads and those roads where the access needs would be adequately met by a maintenance level 1-2 road. Consider this option during subforest scale roads analyses, as this can be a cost effective alternative. Reduced maintenance of these roads should not result in any increased watershed risks as the most basic road maintenance will focus on maintaining road drainage. The reduced maintenance should only result in reduced user comfort. Less use due to reduced user comfort will further decrease the potential for road-related watershed risks.
- Provide travelers with sufficient information necessary to decide which road(s) they will travel. When appropriate, utilize entrance treatments, warning signs, route markers, and information bulletin boards to advise travelers of conditions ahead.
- Do not post speed limit and other regulatory signs on roads under Forest Service jurisdiction without a Forest Supervisor's order and a law enforcement plan.

- Consider prohibiting OHV use on Forest system roads when one or more of the following conditions exist:
    - The road is maintained at level 3, 4, or 5 and connects to a state, county, or other public agency road that is similarly regulated.
    - Traffic volumes exceed 100 vehicles per day (SADT) on single-lane roads.
    - Average traffic speed on the road exceeds 25 mph.
- To reduce annual maintenance costs, implement seasonal travel restrictions on roads susceptible to damage during wet or thawing conditions.
- Collect road maintenance and surface rock replacement deposits, as appropriate, on all road use permits and special use permits.

General Guidelines

The following are general road-related guidelines:

- Require authorized, permitted operations utilizing NFS roads to pay their fair share of road maintenance costs.
- Consider road decommissioning when planning projects that involve the construction and use of short-term, single-resource roads: for example, roads planned for mineral projects that undergo exploration, development, and abandonment phases. Incorporating decisions to decommission single-resource roads during the initial stages of project planning helps move the Forest toward the potential minimum road system. Document planned decommissioning when developing road management objectives.
- Develop an annual maintenance plan to prevent deferred maintenance costs from accruing on high value rated roads
- Update the road system databases and keep them current.
- Use an interdisciplinary process to develop, update, and implement road management objectives for all system roads. Ensure that information in the transportation atlas and inventory conforms with approved road management objectives.
- At appropriate intervals, update the data contained in the Road Matrix. Analyze the changes to determine new opportunities that may have developed as new information is collected.
- Require the use of this Routt National Forest Roads Analysis for all subforest scale roads analysis through a Forest supplement to the 7700 Manual.
- At least once every 2 years, perform road condition surveys on all level 3, 4, and 5 roads.

Assessment of Building Roads in a Currently Unroaded Area

This assessment focuses on inventoried roadless areas (IRAs). The 1997 Routt Forest Plan revision evaluated and considered the IRAs for wilderness designation. None of the IRAs were recommended for wilderness designation. Based on management area prescriptions, 67% of the total roadless area acreage will retain roadless character, while 33% will not.

Of the suitable timber base in IRAs, 78% is within one mile of an existing inventoried road. This suggests that while some maintenance level 3-5 road construction would be necessary to implement vegetative management prescriptions, a high percent of the suitable timber in IRAs could be accessed with reconstruction of existing roads, minimal construction of local roads, or temporary roads. However, even with minimal road construction, there are likely to be conflicts over any road construction in IRAs.

A recent Administrative Order suspended implementation of the Roadless Area Conservation Rule, and an interim directive was developed reserving to the Chief of the Forest Service, with some exceptions, authority to approve timber harvest and road construction and reconstruction in roadless areas. As discussed in the TM2-3 and Issue #3, building roads in inventoried roadless areas depends on the outcome of the Roadless Conservation Rule. Depending on the outcome, there may be a future need to amend the forest plan to change management area prescriptions and revise geographic area direction.

Some inventoried roadless and unroaded areas are not conducive to road building due to physical constraints (steep slopes, unstable soils, wetlands) or critical wildlife habitat. These factors are considered during site-specific analysis and may require amending the Forest Plan. Physical constraints were a factor in analysis of proposed projects in the Morrison Creek area and some areas proposed for salvage in the Routt Divide blowdown. However, in other roadless areas, roads can be constructed after proper project planning, analysis, road design, and mitigation.

Opportunities for Addressing Problems and Risks

Travel management: For roads with a low value rating, either decommission or consider ways to raise this value: for example, by providing recreation opportunities along the road. Recreation use on the Forest is increasing and there are road-related opportunities to better disperse this use and lessen recreation impacts occurring elsewhere. An example of increasing recreation use on a low-value road would be to develop a trailhead and trail system at the end of the road. There are many opportunities on the Forest to convert the level 1 and 2 roads to motorized and nonmotorized trails.

Watershed: The watershed assessment identifies potential effects of roads that can impact watershed condition and aquatic habitat. Watersheds and associated aquatic resources at greatest road-related resource risk could be prioritized for separate analyses to better identify specific areas of concern that may need repair. AQ 6 in Chapter 4 identifies watersheds with the highest risk of being affected by the road system.

Wildlife: The wildlife assessment (TW1-3) identified watersheds where roads have a high risk of affecting wildlife, as well as individual maintenance level 3-5 roads that may be affecting wildlife. These roads and watersheds should be prioritized for subforest scale analyses to identify specific areas of concern and opportunities to address these concerns.

Fuel reduction: Fuels reduction funding anticipated for the next several years is another opportunity to address growing urban interface wildfire risks. The IDT placed high resource management values on many of the level 3, 4, and 5 roads that provide primary access to areas around and within the Forest with high densities of cabins, homes, and other structures. These roads may be important access routes for fuel reduction projects, (especially any commercial projects that could involve log hauling) and provide important access for wildfire suppression access and evacuation egress. The ID teams for these fuel reduction planning projects can use the road matrix to begin identifying existing access/egress situation to help define the road-related project proposals.

Deferred maintenance backlog: This Routt National Forest Roads Analysis clearly demonstrates that annual maintenance funding is inadequate to maintain the road system on the Forest. Over time, these roads will continue to incur additional deferred maintenance costs and degrade unless significant road reconstruction funding becomes available. The agency is addressing this issue nationally by proposing a new funding category for the 2004 federal highway transportation funding authorization called Public Forest Service Roads (PFSR). A challenge for this Forest is determining how to prioritize roads for the PFSR funding. The Road Matrix Table revealed that some currently submitted PFSR project proposals are for roads that received a low value rating. This table can be used to prioritize roads for PFSR proposals/funds.

The roads analysis identified an opportunity to improve road-related dialogue with the respective counties. To more efficiently use taxpayer funds, the Forest should continue to pursue formal road maintenance agreements with the counties interested in sharing maintenance.

Issues

Chapter 3 identified the forest scale issues that were carried forward. The following section outlines each issue and identifies opportunities to address each issue. Appendix D summarizes specific concerns expressed by each Ranger District relevant to each issue.

1. **Some roads may not be under the appropriate jurisdiction, and the right of way atlas may not reflect current jurisdiction.**

   The definition of jurisdiction has been subject to different interpretations over the years, which has led to some inconsistent entries in the INFRA database. "Jurisdiction is the legal right to control or regulate use of a transportation facility derived from fee title, an easement, an agreement, or other similar method. While jurisdiction requires authority, it does not necessarily reflect ownership" (FSM 7705).

   FSM 7703.3 discusses jurisdiction over transportation facilities and includes direction for determining which agency should have jurisdiction of a road. Once appropriate jurisdiction is established, opportunities for shared maintenance on joint use roads should be explored to make the most efficient use of public funds.

   Opportunities to address jurisdiction and maintenance concerns include the following:

   - Conduct a thorough review of jurisdiction and legal rights-of-way for all roads, especially roads with current projects proposed.
   - Bring lands and engineering specialists into the project early to help determine if access is going to be an issue.
   - Update the Forest right-of-way atlas (FSM 5490).
   - Keep existing road maintenance agreements (Schedule A) updated.
   - Pursue agreements with other counties and land management agencies.
   - When road use patterns change, review road for appropriate jurisdiction and maintenance responsibility.
   - Pursue new rights-of-way where forest access is not adequate for management needs.
   - Encourage counties to assume jurisdiction on portions of roads that access subdivisions.

   Relevant questions: GT3, SI5, CH1-3.

2. **Road maintenance funding is not adequate to maintain roads and signs to standard.**

   The annual cost to maintain the entire road system to standard is considerably higher than the amount allocated by Congress. The experienced budget level from the forest plan projected $840,000 per year. Desired condition budget level was projected as $1,193,000. Historic budget for the road program in the last five years has roughly been about $560,000. Due in large part to this funding shortfall, there is a need to identify and prioritize the potential minimum road system necessary for access to and management of the Forest.

   The largest proportion of road maintenance and improvement funds allocated to the Forest is spent on the higher standard roads. Safety work such as surface maintenance, roadside clearing, and installation and maintenance of warning and regulatory signs are performed on an annual basis.

   Reducing the maintenance level of the road (and comfort level to the user) is one method of reducing the costs.

Opportunities to address funding issues include the following:

- Prioritize funding to address critical health and safety needs.
- Ensure road maintenance level is appropriate to meet the expected traffic on the road for the management needs as described in the RMOs.
- Decrease the required annual road maintenance costs by correcting deferred maintenance work items.

Relevant questions: GT4, EC1-3.

3. Road access may not be adequate for future management needs.

There are specific areas of the Forest where road access may not be adequate to address future management needs. Responses to questions TM2-3, EF3-4 and PT1 conclude that, in general, the objective maintenance level 3 - 5 system is sufficient to: 1) manage the suitable timber base, 2) access timber stands in need of silvicultural treatment, 3) access areas of the Forest areas in response to disturbance events, and 4) implement fuel reduction treatments in the wildland/urban interface. However, the responses also note that there are exceptions to the general statements and identify specific areas where access is limited.

Areas identified as lacking adequate access include suitable timber base and other lands, both within, and outside of Inventoried Roadless Areas (IRAs). Lack of developed access may be the result of physical constraints (steep slopes, unstable soils, wetlands), critical wildlife habitat, and/or a lack of right-of-way. In addition, road building in IRAs or other unroaded areas has been, and will most likely continue to be, a contentious issue.

A related issue to the lack of adequate access is that the access that is developed is often for a single purpose. As discussed in the response to TM2-3, a large part of the planned road construction and reconstruction projected in the 1997 FEIS was to provide access to suitable timberland. While the majority of the planned construction and reconstruction would consist of local roads, there would also be some additions to the collector system.

Developing road systems to access IRAs, whether to manage the suitable timber base or other lands, will depend on the re-examination of the Roadless Rule and current and pending litigation. As discussed in the response to TM2-3, the final rule published in the Federal Register on January 12, 2001 prohibits road construction, reconstruction, and timber harvest in IRAs. Depending on the outcome of the reexamination and litigation, forest plan amendment may be required to change affected management area prescriptions and geographic area direction.

Opportunities to address this issue include:

- See opportunities for addressing lack of rights-of way listed for issue #4.
- Determine the feasibility of accessing those areas that currently have inadequate access. Feasibility should take into consideration environmental and social effects, as well as costs. Where the feasibility analysis determines access to be too expensive, or having too great of environmental or social effects, consider a forest plan amendment where the management prescription would not require access.

Relevant questions: GT2, EF3-4, TM2-3, PT1.

4. Right-of-way across private land may not be adequate to access the forest as ownership and land uses change. Historic access across some of these lands is being closed off to the public. While this is not a change in legal status, it gives the appearance of shutting off large tracts of public land.

There is a concern that historic use agreements are becoming outdated. Inholdings and adjacent lands are being sold and subdivided, a trend brought on by plummeting economics in agriculture and accelerating

values in lands with nearly exclusive access to public lands. In addition, some landowners are no longer allowing access for hunting because of an increase in abuse of those permissions.

The ability to acquire a right-of-way (ROW) in a timely manner could be affected by many factors. Willingness of the landowner to convey a ROW is one of the most important considerations. Disagreement on values, location, and terms of the proposed easement can slow down and even stop an acquisition. Lack of availability of Realty staff with skills needed to process a ROW is a factor, as well as other competing lands priorities.

Advanced planning on the part of all program areas is critical to ensure that funding and skills are available to process the ROW at the proper time. Access needs to be considered early in the project planning stages to allow adequate time to negotiate with landowners and process (appraisal, survey, title work, etc.) the ROW case. This planning should consider alternative routes should the preferred ROW be unobtainable within the desired timeframe.

There are other concerns over exclusive use of nonmotorized areas by adjacent landowners, specifically for OHV riding and illegal outfitting. These activities are difficult to manage when the Forest Service can't get into the area without asking these very landowners for permission to cross their land. Access into some areas, like the Troublesome Geographic Area, is difficult for everyone, including the Forest Service.

According to the USDA Forest Service internal reference to Access and Travel Management questions, dated May 2, 2002 (on file): the Department of Agriculture has the authority to condemn a ROW to maintain access corridors, although there are some exceptions. The Forest Service may only request condemnation action; it is up to the Secretary of Agriculture to decide when we will use it. Close coordination with the Office of General Council is needed when contemplating a condemnation action. Every effort must be made to acquire a ROW through voluntary means before considering condemnation, and these efforts must be carefully documented. Condemnation is usually considered an action of last resort but is a valid tool; assuming legal authority exists for the subject lands.

According to the 1997 Forest Plan EIS, as of 1983, 43 rights-of-way had been acquired, with 51 more to be acquired. The 51 additional ROW are more complex than the 43 already acquired. Examples include: the Pagoda area (Seeley road), Troublesome, and Elk Park road (NFSR 314).

Opportunities to address this issue include:

- When working on subforest scale RAPs, identify opportunities to obtain legal access.
- Update and maintain the ROW atlas with current jurisdiction information. This will help to clarify historic use versus legal access.
- When working on projects regarding ROW acquisition opportunities, consult lands and engineering specialists early in the process.
- Communicate with local planning commissions to keep up-to-date on requests for subdivisions and other land use changes. Ensure the commissioners understand our year-round access issues (see Issue #5 in this section) and 36 CFR 212.6 and 212.7.
- Review the Routt National Forest Plan, Chapter 1, Page 23, Infrastructure – Travelways Standard #6, and Pages 24, 25, Real Estate – Land Adjustments, all Standards and Guidelines.

Relevant questions: SU1, UR/RR1, SI1, GT2-3.

5. There are increased demands for year-round access across Forest to private inholdings which may affect the road system and resources.

There is an increasing demand for year-round access across NFS lands to private inholdings. Historically, private inholdings have been accessed in the snow free months or 'summer' and did not require any additional work other than standard road maintenance. However, the shift from summer only

use to year-round use poses concerns regarding 1) the effects of year-round use on the integrity of the road, 2) safety, 3) direct and indirect environmental and social effects, and 4) the affect of year-round access on winter use patterns.

In many cases, year-round use means more than access by snowmobile or snowcat; the demand for standard vehicle access is increasing. Due to the climate of the Routt National Forest and the prevalence of snow during the winter, year-round access for vehicles usually requires snowplowing.

A road plowed for winter use has the potential to change winter use patterns. Plowing the road allows standard vehicle access to areas that were previously unavailable in the winter. This can result in an increase in winter activities (e.g., snowmobiling, cross-country skiing, Christmas tree cutting) in areas which previously were not as accessible. Plowing can also encourage trespass on private lands because property markers are often not as visible in the winter months. Snowplowing plans should have provisions for turn-around and parking areas.

Access to private inholdings across NFS lands requires a special use permit. Certain procedures must be followed to obtain a special use permit. The following provides guidelines to consider including in the permit and opportunities to reduce the effects of winter access on resources.

- Follow procedures outlined in 36 CFR 212.6 and 212.7, and the Routt National Forest Plan, in particular Infrastructure – Travelways Standard #6, and Real Estate – Land Adjustments, all standards and guidelines.
- Develop a monitoring plan that addresses site-specific issues and ensures adequate road maintenance to withstand plowing procedures and winter use.
- Develop a road maintenance plan which outlines responsibilities and projected costs to be covered by the proponent.

Opportunities to address engineering concerns include:

- When issuing easements, contracts or permits to plow roads during the winter or authorize use outside the normal operating season, consult appropriate engineering staff to determine the need for reconstruction, maintenance, and snowplowing requirements.
- Attach standard specification 803 or equivalent to all authorizations for snow removal on roads. The specification may be accessed at http://www.fs.fed.us/database/acad/dev/roads/803.doc. Timber sale contracts address snow removal through the regional C-provision RO-C(T)5.36# - Snow Removal (9/01).
- Upgrade the road surface, as needed, to accommodate use during saturated and thawing conditions.
- If there is inadequate parking and turnaround space at the end of plowing, then consider restricting winter use to only the permittee.
- To reduce road damage and decrease the cost of plowing, limit use to the permittee.

Opportunities to address safety concerns include:

- Consider requiring marking and signing roads, adding turnouts, and constructing alternative trails for winter use when the road width and geometry does not provide safe passage for mixed traffic.
- Ensure that intersection approach grades are appropriate for winter conditions (intersections may need to be relocated). Intersection approach grades that are adequate in dry conditions may be too steep to negotiate on snow-covered roads.
- Consider requiring management of snow berms (removal, etc.) to improve sight distance. Sight distance may be impaired by snow berms, particularly at intersections.

Opportunities and guidelines to reduce the effects of winter use on the soil and water resources include:

- Do not plow snow and debris directly into stream courses.
- Remove or breach snow berms created through snowplowing to avoid accumulation or channelization of melt water on the road and prevent water concentration on erosive slopes or soils. This should include an adequate number of breaches or breaks in the snow berm to allow frequent drainage of water from the road surface. Spacing of the breaches is highly dependent on slope, soil type, and road design.
- Suspend or limit road use to colder portions of the day when the road surface is frozen to prevent road surfaces from deteriorating under use during thawing temperatures. Suspend road use when ruts exceed three inches in depth for a length of 100 to 200 feet depending on grade. If this is a problem, upgrade the road surface to a standard so that rutting does not occur.
- Mark all culverts and low water crossings prior to snowfall. Ensure that the culverts and crossings are open and functioning throughout the winter and at the beginning of spring snowmelt. Remove all snow fills and restore the natural stream crossing on any natural stream or low-water crossing prior to spring snowmelt to prevent the development of ice-dams.
- Plow the road surface when temperatures are consistently below freezing to promote freezing of the road. This will remove the insulation provided by the snow allowing the subgrade to freeze to a greater depth and reduce road surface damage that might occur from use during unfrozen conditions.

Opportunities and guidelines to reduce the effects of winter use on wildlife include:

- Consider restricting winter use to only the permittee being given the permit to snowplow.
- Consider restricting snow compaction activities like snowmobiling from areas made newly accessible by snowplowing. This likely is most important for wet meadows and riparian areas where species vulnerable to snow compaction (e.g., amphibians, meadow voles) are most likely to occur.

Relevant questions: AQ1-2, AQ4, TW1-4, GT2-3, SU1, UR/RR2, SI1, SI4-5, WU1.

6. **There are potential adverse environmental impacts from the current road system. Roads causing adverse impacts should be prioritized for evaluation at the subforest scale. (This statement can apply to the entire road system; however, only impacts from maintenance level 3, 4, and 5 roads are addressed in this analysis.)**

   Scientific studies and documentation in the past decade have revealed a number of adverse impacts caused by roads (USFS 2000). Many of these impacts are discussed in Chapter 4, particularly in the answers to the aquatic, terrestrial wildlife, and ecosystem function questions. The watershed and wildlife risk assessments rate the potential risk to each watershed from the current road system. The wildlife risks considered include road density and snow compaction in riparian habitats (see TW1-2). Watersheds with the highest risk of affecting watershed function and riparian dependent species are listed in the table below and should be the highest priority for subforest scale analysis. These are watersheds with a high rating in either the watershed or riparian dependent species column, and at least a moderate rating in the other column.

Table 36. Watersheds with the highest potential for adverse impacts to the watershed and aquatic risk and aquatic or riparian dependent species from the existing road system.

Watershed Name	Watershed Number	Major River Basin	Aquatic Risk	Riparian Dependent Species Risk
Grizzly Cr Headwaters	101800010101	North Platte	Moderate	High
Coyote Cr	101800010103	North Platte	High	High
Illinois River Headwaters	101800010201	North Platte	High	High
Willow Cr	101800010204	North Platte	High	High
South Fork	101800010301	North Platte	Moderate	High
Pinkham Cr	101800010703	North Platte	High	High
Camp Cr	101800020102	North Platte	Moderate	High
N. Fk. Big Cr	101800020302	North Platte	Moderate	High
Corral Cr	140100011204	Colorado River	High	High
Muddy/Milk Cr	140100011402	Colorado River	High	High
Red Dirt Cr	140100011406	Colorado River	High	High
Upper Egeria Cr	140100012200	Colorado River	Moderate	High
Upper Rock Cr	140100012202	Colorado River	High	High
Reed Cr	140500010105	Yampa River	High	High
Lower Willow Cr	140500010106	Yampa River	Moderate	High
Upper Willow Cr	140500010107	Yampa River	High	High
Elk River @ Glenn Eden	140500010108	Yampa River	High	High
Lower Bear River C	140500010302	Yampa River	Moderate	High
Oak Cr	140500010401	Yampa River	High	High
Walton Cr	140500010406	Yampa River	Moderate	High
Soda Cr	140500010408	Yampa River	Moderate	High
Elkhead Cr	140500010601	Yampa River	High	High
Cottonwood Cr	140500010703	Yampa River	Moderate	High
Little Snake R.-Whiskey Cr	140500030101	Little Snake River	High	High
King Solomon Cr	140500030102	Little Snake River	High	High
Upper Slater Cr	140500030301	Little Snake River	High	Moderate
Middle Slater Cr	140500030302	Little Snake River	High	Moderate
Upper Fourmile Cr	140500030501	Little Snake River	High	High

General Opportunities

- Use the previous table to prioritize subforest scale analyses to identify opportunities to reduce environmental impacts.
- Use this priority table to support special funding requests

The following is a list of opportunities related to the soil, water, riparian, and aquatic resources.

Opportunities/recommendations to consider if roads are likely to modify surface and subsurface hydrology:

- Design roads to minimize interception, concentration, and diversion potential.
- Design measures to reintroduce intercepted water back into slow subsurface pathways.
- Use outsloping and drainage structures to disconnect road ditches from stream channels rather than delivering water in road ditches directly to stream channels.
- Evaluate and eliminate diversion potential at stream crossings.

Opportunities to reduce surface erosion:

- Increase the number and effectiveness of drainage structures.
- Improve the road surface by either gravelling, or adding a binding material to those roads that have native surfaces with no inherent binder.

Opportunities to address existing roads in areas with high mass wasting potential:

- Relocated roads to areas with more stable soils.
- Relocate drainage structures so that the outlets are on less sensitive areas which may include flatter slopes and better-drained soils.

Opportunities to improve local channels at road-stream crossings:

- Design crossings to pass all potential products including sediment and woody debris, not just water.
- Realign crossings that are not consistent with the channel pattern.
- Change the type of crossing to better fit the situation; for example, consider bridges or hardened crossings on streams with floodplains, and consider bottomless arch culverts in place of round pipe culverts.
- Add cross-drains near road-stream crossings to reduce the connected disturbed area.
- Reduce the number of road-stream crossings to minimize the potential for adverse effects.

Opportunities to reduce the effects of the road system on wetlands:

- Relocate roads out of wetland areas.
- Where relocation is not an option, use measures to restore the hydrology of the wetland. Examples include raised prisms with diffuse drainage such as french drains.
- Set road crossing bottoms at natural levels of wet meadow surfaces.

Opportunities to address road-stream crossings that restrict migration and movement of aquatic organisms:

- Reset the culvert to eliminate the limiting factor.
- Replace the culvert with an alternative crossing such as bridge, hardened low-water ford, or bottomless arch culvert.

Opportunities to address roads that affect riparian plant communities:

- Relocate roads out of riparian areas.
- Restore the hydrology in riparian areas that have been dewatered by the road system.

Opportunities to reduce the effects of roads on wildlife and their habitat:

- Avoid building roads in old growth or old-growth recruitment stands in order to reduce further fragmentation of a cover type that is most useful to wildlife when it exists in large patches.
- Obliterate and rehabilitate existing level 1 or low-value level 2 roads in old growth or old-growth recruitment stands in order to restore larger tracts of old-growth forest.
- Reduce the objective-maintenance level of, or close, roads leading to or through rock outcrops, especially those outcrops that provide substantial habitat for species of interest.
- Strategically close certain low-value roads to reduce the encroachment of recreationists into wildlife habitat, especially in areas where noise and off-trail disturbance presents risks to breeding species.
- Seasonally close certain areas of wildlife concern to reduce the effects of motorized vehicles, including snowmobiles, on wildlife behavior, breeding, and survival.
- Designate snowmobile activity to areas where wildlife concerns are minimal. In particular, exclude snowmobile activity in riparian zones, wet meadows, and lynx habitat.
- Restrict road use to less critical times of year for surrounding species of concern and avoid the breeding season for species of concern.

Increasing use of the road system requires more maintenance. However, as stated in Chapter 2, the road maintenance budget is not adequate to maintain the existing road system. Resource concerns associated with the road system could be exacerbated by increased use and inadequate maintenance. Opportunities to address this concern are similar to those outlined under issue number 2.

Aside from the resource concerns addressed above, the HPBE district identified several resource concerns associated with US Highway 40 (US 40) over Rabbit Ears Pass. Concerns include:

- The effects of magnesium chloride and snowplowing on water quality and roadside or adjacent vegetation.
- Sanitary concerns associated with camping in the plowed parking areas during the winter months.
- The effects of scoria 'deltas' on water quality and roadside vegetation.

The primary opportunities to reduce these effects include:

- Work with the Colorado Department of Transportation to develop the best winter management option of US 40 which provides for user safety, yet protects resources.
- Develop a winter travel management plan that includes adequate parking facilities to accommodate winter camping in the parking lots.

Relevant questions: AQ1-6, AQ8-12, AQ14, TW1-4, SI3.

7. Higher road densities have greater potential to adversely affect resources and encourage illegal use.

When considering the impacts of road density, it is appropriate to consider all levels and types of roads. The negative effects of roads on resources (Issue 6) become magnified with increased road density. Forman et al. (1997) demonstrated that certain wildlife species experience population declines when road densities reach a threshold of about 1 mile/mile^2.

Increased erosion, sedimentation, alterations to hydrology, number of road crossings, population isolation, disturbance to wildlife, fragmentation of wildlife habitat, edge effects, and degradation of big game hunting all increase as road density increases. High densities of level 3-5 roads may pose less of a risk to aquatic systems than level 1-2 roads because of the enhanced maintenance associated with the former. However, high densities of level 3-5 roads often pose a higher risk to terrestrial wildlife (e.g., population isolation, vehicle collisions, barriers to dispersal) than level 1-2 roads because of the higher traffic volume and larger road prism on level 3-5 roads.

Level 3-5 roads present a vector by which motorized vehicles can access level 1-2 roads, as well as unclassified roads. Although level 1 roads are technically considered closed by the Forest, as many as half are still passable for motorists who disregard such closures. Additionally, unclassified roads are user-created roads which do not incorporate best management practices to minimize the effects on resources. For this reason, unclassified roads often have the greatest effect on resources but are often not included in the analysis process since they are not part of the database.

Higher road densities of level 2-5 roads may actually promote the development and use of unclassified roads. In areas of relatively higher road density, users see more opportunities to make illegal shortcuts between two or more official travel routes; when road density is relatively low and dense vegetation impedes the users' view of potential shortcuts, fewer unclassified roads may be created. In some areas on the Routt National Forest, the sum of unclassified roads through level 5 roads creates areas of especially high road density. For instance, the locations of level 3-5 roads in the Owl Mountain, Green Ridge (Parks RD), and Gore Pass areas make many miles of level 1-2 roads available to motorists, thereby encouraging the use of said roads. Furthermore, the layout of those level 1-2 roads is such that it highly fragments the wildlife habitat. Hunting season is especially problematic in this sense, because some hunters use the higher-level roads to access the lower-level (including closed or unclassified) roads. Hunters are often motivated to seek remote locations where big game might be found. This intrusion of motorists and hunters into big-game security areas causes the ungulates to move off forest and onto private lands early in the hunting season (Issue 9 and Question TW3).

Questions TW1-4, AQ1, and AQ6 address the consequences of high road density (level 1-5) on wildlife and aquatic resources. Question AU1 addresses the illegal use of roads. Though road densities were considered in the wildlife-risk and the watershed-health assessments and incorporated into the overall watershed and wildlife risk ratings, there was a compounding factor in that unclassified roads were not considered in these analyses because they were not part of the database. Watersheds with an already high density of classified roads are at an even greater risk as the density of unclassified roads increases.

Opportunities

- Develop an education program regarding the adverse effects of both off-road travel and motorized use of closed roads on wildlife and aquatic resources. Education may be the best tool to discourage additional development and use of unclassified roads.
- Develop a strategy to inventory unclassified roads. The strategy should focus on watersheds already identified as high priority for subforest scale analyses in AQ6 and TW1, as well as under Issue #6.
- Analyze level 1-2 roads to identify restriction, closure, and decommissioning opportunities.
- Analyze level 3-5 roads that feed high densities of level 1-2 roads to identify restriction and closure opportunities that would reduce the negative effects of level 1-2 roads. Areas on which to focus include Owl Mountain (Roads 103.1 and 700.1), Green Ridge (Road 106.1), and Gore Pass (Roads 185,1, 206.1, 243.1, and 250.1).

Relevant questions: AQ1-2, AQ4, AQ6, AQ9-10, AQ12, AQ14, TW1-4, UR/RR2, AU2, GT4, SI1.

8. Ineffective closures may have adverse affects on resources, and can encourage illegal use.

Closed roads still provide access to otherwise inaccessible parts of the forest, specifically places where other people aren't around. This is an enticement for many users, especially hunters looking for big game that haven't been spooked by other hunters on open roads. The Forest Service's timber program is the usual road-building program, building both classified and temporary roads. As timber sales can take up to 10 years to complete, visitors to the Forest can get used to these roads by the time they are finally closed (after the sale closes). Gates and berms have proven ineffective in keeping many users off the roads. This is generally only an issue on level 1 and 2 roads.

In addition, previous travel management direction was centered on the illegal use of the road, and not the area surrounding the road. Local users are accustomed to using these areas and are not familiar with the travel management decisions that closed all areas to off-road motorized travel. As a result, use is continuing in some areas, and the Forest Service is having a difficult time enforcing the travel management regulations. The better solution would be to plan and design more effective closures, combined with better signing and education.

Opportunities to improve closure effectiveness include:

- Use closure methods that provide hydrologic stability and eliminate vehicle travel. Methods can include ripping and seeding, constructing berms and water diversion structures, removing culverts, pulling slash and stumps across the road bed, scattering boulders, putting the road back to the original contours, planting trees and shrubs in the roadbed, gates and signs. The most effective closure methods should be identified on the ground based on site characteristics.
- When locating temporary or classified roads, consider effective closure opportunities. Use road closure devices and methods that are most appropriate to terrain.
- Install temporary closures immediately on newly constructed roads that are not part of the permanent open road system (e.g., temporary or level 1 roads) so users do not become accustomed to using these roads.
- Consider future needs of the road when determining closures: for example, decommissioning vs. level 1 closures.
- Inform users of type of travel permitted on Forest roads through appropriate signing and education, especially when the road crosses through different agencies' jurisdictions.

Relevant questions: AQ TW1-4, AU2, GT4, UR/RR1-2, SI1

9. Management of the road system may be affecting big-game movement during hunting seasons.

According to the Routt National Forest Plan EIS, pages 3-127 (wildlife) and 3-164 (recreation) the effects of road density on big game include lower hunter success rates as big game move onto private adjacent lands earlier in the season. Following is the wildlife discussion:

> "Generally the level of disturbance and displacement of elk and other wildlife will increase as roads and associated human activity increases. The relationship between elk and roads has been shown to be mainly behavioral. When new roads are constructed, there is an initial period of learning and adapting, but over time a specific, consistent, and measurable use pattern develops. The result is a decline of usable habitat. Most of the habitat can be reclaimed by restricting access to nonmotorized traffic (Lyon 1990)."

The effect of the road system on big game movement and harvest rates is discussed in TW3. The human activity associated with the Forest road system and the subsequent movement of big game off the Forest is one contributing factor to the excessively high big game population on the Routt National Forest. Subsequently, a high big game population can result in poor forage conditions in grass, willow, and aspen

communities. These impacts tie directly to road density (Issue 7); increased road density reduces deer and elk security areas and increases their movement off-Forest.

Opportunities to reduce road effects to big game movements:

- Close roads during the hunting season in strategic areas where such closures would decrease fragmentation of big game habitat and increase big game security areas, with the goal of increasing hunter success on the Forest.
- Educate the hunting public regarding the goal of hunting-season road closures and the reason such seasonal road closures could improve hunter success and hunter satisfaction.

Relevant questions: TW2-3, UR/RR2, SI2

10. Both off-highway vehicles (OHVs) and highway vehicles are used on the same roads and occasionally at the same time. This can be a safety problem.

There is a potential for hazardous driving conditions when there is mixed use traffic on public roads. Safety concerns and travel management restrictions should be addressed in the RMOs, especially where mixed traffic use is a concern. Appropriate signing and education can help alleviate the safety concerns. RMOs should be updated to reflect changes in management or resource needs. Documenting the primary use of the road and any safety concerns can also help prioritize funding for critical health and safety concerns, including signing.

Travel management regulations are posted on the ground and described on the Forest Visitor's map. These regulations have been established by the Forest to enable safe motorized travel while protecting natural resources and minimizing conflicts between users. Off-road recreational vehicles such as trail motorcycles and ATVs are allowed on higher standard arterial and collector roads unless specifically prohibited.

Colorado state law governs registration of off-road vehicles. This law also applies to out-of-state visitors. These licensed vehicles can then be operated on public roads, including designated Forest Service roads and trails. An effort for consistent signing statewide will show which uses are allowed on each road and trail. Over the next few years, these signs will be installed on all Forest roads and trails. Some counties have separate restrictions for off-road vehicle travel on county roads. Users should be educated when allowed uses change as different jurisdictions are crossed.

Law enforcement responsibility for road related regulations are sometimes unclear. Signing and law enforcement responsibility on roads can be further defined by agency in joint use maintenance agreements (Schedule A). Efforts to keep signing and closure orders up to date and educating the public about permitted road uses can help improve consistency in law enforcement efforts.

Opportunities for safety-related road issues:

- Identify road jurisdiction by using appropriate agency route markers.
- Inform users of type of travel permitted on Forest roads through appropriate signing and education, especially when the road crosses different agencies' jurisdictions.
- Prioritize funding to address critical health and safety needs.
- Ensure road design is adequate to meet the expected traffic on the road to meet the management needs as described in the RMOs. Keep RMOs up to date.
- Establish and maintain proper signing, as set forth in MUTCD, on roads subject to the Highway Safety Act (most maintenance level 3, 4, and 5 roads).
- Consider restricting OHV use on roads where this is a concern.

Relevant questions: GT4, WU1, AU2, UR/RR1, SI5.

11. Roads may be promoting illegal motorized use into wilderness areas.

Certain roads provide access for motorized users to the wilderness boundary. Once at the wilderness boundary, there is a temptation to continue into the wilderness, resulting in illegal use. While this is a difficult issue to address, education is the primary opportunity for reducing this illegal use.

The Forest Service works with Tread Lightly! Inc, the International Association of Snowmobile Administrators, the American Council of Snowmobile Associations, the National Off-Highway Vehicle Conservation Council, and other national interest groups and volunteer associations to promote responsible vehicle operation. Individual forests need to improve their contacts with local groups to provide users with additional education and assistance.

Making a concerted effort to install signs at boundaries and trailheads is another education opportunity. If this is not successful, the Forest can, and has, obtained permission from the Regional Forester to use snowmobiles to pursue snowmobile trespassers.

Opportunities to address illegal use:

- Inform users of type of travel permitted on Forest roads through appropriate signing and education.
- Develop an education program to help users understand appropriate motorized and nonmotorized uses.

Relevant questions: AU2, GT3, UR/RR2-3, UR/RR5, UR/RR7.

12. Road management objectives (RMOs) are not current and need to be updated.

Road Management Objectives (RMOs) are developed for each road in accordance with FSM 7712.5. Road management objectives establish design criteria (FSM 7720) and operation and maintenance criteria (FSM 7730.3) for each road. RMOs require approval and signature by the District Ranger and Forest Engineer and become part of the road atlas (FSM 7711.1). Safety concerns and travel management restrictions should be addressed in the RMOs, especially where mixed traffic use is a concern. Documenting the primary use of the road and any safety concerns can also help prioritize funding for critical health and safety concerns.

A review of road maintenance levels and jurisdiction for the forest showed a need to have the RMOs updated to reflect current management needs. RMOs should also be reviewed and updated during the planning process for all projects involving roads.

Opportunities to address concerns with Road Management Objectives:

- Ensure road design is adequate to meet the expected traffic on the road for the management needs as described in the RMOs.
- Update RMOs, and keep them up to date.
- Require updates to RMOs as part of subforest scale analyses.

Relevant questions: GT3-4, AU2.

NEPA analysis needs

This roads analysis does not need any NEPA analysis as it provides information and opportunities for subforest scale roads analyses. Any decisions which change management of the road system resulting from subforest scale roads analyses will require the appropriate level of NEPA analysis.